COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Assessment of the ecological condition of surface waters (ocena stanu ekologicznego wód powierzchniowych) (KIERUNKOWE)**	Course code: **SPR201AIJ3450_25S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic**
Specialty:	
Course / module status **obligatory**	Language of instruction: **semester: 4 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	4	discussion classes	30	0	pg	5
		zajęcia terenowe	15	0	pg	
Total			**45**			**5**

Course / module coordinator	**dr TOMASZ KREPSKI**
Course instructor	**dr TOMASZ KREPSKI**
Course / module objectives	**The aim of the course is to familiarize students with the latest methods of surface water monitoring using biological, geomorphological and physico-chemical methods. The student should be able to choose the appropriate method to assess the condition of surface waters and carry out the collection and analysis of the samples, interpret the results and draw conclusions. The student is ready to constantly update the knowledge of water monitoring and initiate actions for protection the environment.**
Prerequisites	**The student should know the basic concepts of limnology and potamology and be able to recognize aquatic organisms**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**The student knows and understands the basic research, laboratory and field methods and techniques used in the monitoring of the aquatic environment**	**K_W02 K_W07**
	2	**EP2**	**The student knows and understands the basics of mathematical calculation methods that enable the proper assessment of the condition of the water environment**	**K_W08**
skills	**1**	**EP3**	**The student is able to choose the appropriate laboratory and field methods and research techniques and correctly use them in the monitoring of the aquatic environment**	**K_U03 K_U04**
	2	**EP4**	**The student is able to make mathematical calculations on the basis of the collected data enabling the proper assessment of the condition of the water environment**	**K_U01 K_U02**
	3	**EP5**	**The student is able to properly present the results of the monitoring, along with the correct interpretation of the obtained results**	**K_U05**
social competences	**1**	**EP6**	**The student is ready to carry out the monitoring in a reliable manner with respect to ethical principles and to share the collected data.**	**K_K03 K_K05**

CONTENT	Semester	No. of hours	including e-learning

Subject title: **Assessment of the ecological condition of surface waters (ocena stanu ekologicznego wód powierzchniowych)**			
Format of instruction: **discussion classes**			
1. **Biological monitoring of aquatic environment - phytoplankton**	4	4	0
2. **Biological monitoring of aquatic environment - macrophytes**	4	4	0
3. **Biological monitoring of aquatic environment - zooplankton**	4	4	0
4. **Biological monitoring of aquatic environment - benthic macroinvertebrates**	4	4	0
5. **Biological monitoring of aquatic environment - fishes**	4	4	0
6. **River Habitat Survey (RHS)**	4	4	0
7. **Monitoring of physical and chemical parameters of water**	4	2	0
8. **Analysis of the collected results, passing the course**	4	4	0
Format of instruction: **zajęcia terenowe**			
1. **Methods of collecting biological samples (zooplankton, benthos)**	4	3	0
2. **Processing and analysis of the collected material**	4	6	0
3. **The Macrophyte Index for Rivers (MIR)**	4	3	0
4. **River Habitat Survey 4 3 0**	4	3	0

Modes of delivery	**Presentation of methods of monitoring research, calculations and analysis of monitoring data, presentation and discussion of the results of water environment monitoring** The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	PROJEKT	**EP1,EP2,EP3,EP4,EP5**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP6**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	
	Preparation of two reports: one of the seminars and the other of the field classes. Positive grade from reports.
	Grade calculation principles
	The final grade for the course is the average of grades from room and field classes.

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	4	Assessment of the ecological condition of surface waters (ocena stanu ekologicznego wód powierzchniowych)		Arytmetyczna	
	4	Assessment of the ecological condition of surface waters (ocena stanu ekologicznego wód powierzchniowych) [ćwiczenia]	zaliczenie z oceną		
	4	Assessment of the ecological condition of surface waters (ocena stanu ekologicznego wód powierzchniowych) [zajęcia terenowe]	zaliczenie z oceną		

Basic reading	Frank R. Burden; Ulrich Foerstner; Ian D. McKelvie; Alex Guenther (2002): Environmental Monitoring Handbook, The McGraw-Hill Companies, Inc, United States of America
Supplementary reading	David B Lindenmayer, Gene E Likens (2018): Effective Ecological Monitoring, The Commonwealth Scientific and Industrial Research Organisation

STUDENT WORKLOAD

	No. of hours	
		including e-learning

Contact hours	**45**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**25**	**0**
Private reading and studying	**20**	**0**
Participation in tutorials	**5**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**28**	**0**
TOTAL workload	**125**	
ECTS credits	**5**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Bioinformatics (bioinformatyka) (KIERUNKOWE)**	Course code: **SPR201AIJ3450_16S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status: **obligatory**	Language of instruction: **semester: 3 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	discussion classes	30	0	pg	2
Total			**30**			**2**

Course / module coordinator	**dr hab. LIDIA SKUZA**
Course instructor	**dr hab. LIDIA SKUZA**
Course / module objectives	**To introduce students to basic issues in bioinformatics, in particular to techniques of amino acid and nucleotide sequence analysis** **To introduce students to biological screening methods and literature databases** **The student acquires practical skills in using biological databases and is able to use basic and specialized programs as well as bioinformatics tools, is aware of the importance of these tools in scientific research, is ready to systematically deepen knowledge by learning new programs and methods used in bioinformatics**
Prerequisites	**Basic computer skills, knowledge of genetics**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**The student has knowledge of the basic techniques of bioinformatic sequence and structure analysis of biopolymers**	**K_W02 K_W06 K_W08**
	2	**EP2**	**The student has knowledge of terminology used in conducting research with bioinformatics methods**	**K_W01 K_W08**
skills	**1**	**EP3**	**The student uses basic functions of specialized bioinformatics software used to compare and edit amino acid and nucleotide sequences and to analyze the spatial structure of proteins**	**K_U03 K_U04**
	2	**EP4**	**The student is able to independently analyze the data available in biological and literature databases**	**K_U02 K_U04**
social competences	**1**	**EP5**	**The student is ready to work independently and in a team on the implementation of projects involving bioinformatic data analysis**	**K_K01 K_K05**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Bioinformatics (bioinformatyka)**			
Format of instruction: **discussion classes**			
1. **Capabilities and example applications of basic bioinformatics systems and biological databases (NCBI Entrez, RCSB PDB, Uniprot, Expasy, PROSITE i PRINTS, Gene Ontology)**	3	8	0
2. **Techniques for quantitative comparison of amino acid and nucleotide sequences (BLAST, FASTA, Clustal)**	3	8	0
3. **Basic methods of molecular phylogenetic analysis (models of molecular evolution, distance and optimization methods for determination of phylogenetic trees)**	3	8	0
4. **DNA barckoding analysis**	3	6	0

Modes of delivery	**case studies, problem solving, lecture with multimedia presentation, exercises**	
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.	
Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP3,EP4,EP5**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	
Grading criteria	**Final test - includes knowledge of exercises and recommended literature** **Presentation of the results based on skills acquired during the course**	
	Grade calculation principles	
	The final grade is the grade for the course	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	Bioinformatics (bioinformatyka)		Ważona	
	3	Bioinformatics (bioinformatyka) [ćwiczenia]	zaliczenie z oceną		1,00

Basic reading	Andreas D. Baxevanis (Editor), B. F. Francis Ouellette (Editor) (2004): Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition, Wiley
	Paul G. Higgs Teresa K. Attwood (2005): Bioinformatics and Molecular Evolution, Blackwell Publishing Ltd.
Supplementary reading	

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**30**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**3**	**0**
Private reading and studying	**5**	**0**
Participation in tutorials	**5**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**5**	**0**
TOTAL workload	**50**	
ECTS credits	**2**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Herpetology and mammalogy (herpetologia i teriologia) (KIERUNKOWE)**	Course code: **SPR201AIJ3450_21S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 4 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	4	discussion classes	15	0	pg	3
		lecture	15	0	pg	
Total			**30**			**3**

Course / module coordinator	**dr hab. ŁUKASZ JANKOWIAK**
Course instructor	**dr hab. ŁUKASZ JANKOWIAK**
Course / module objectives	**Knowledge about the factors determining the biology of amphibians, reptiles and mammals Ability to identification specimens of amphibians, reptiles and mammals**
Prerequisites	**Knowledge of the zoology at the secondary school grade**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**Defines the sources of biodiversity of amphibians, reptiles and mammals. Discusses the causes of the biodiversity in terms of time and geography**	**K_W05**
skills	**1**	**EP2**	**Uses the scientific literature**	**K_U02**
social competences	**1**	**EP3**	**maintains a fact-based and critical attitude in evaluating his own work**	**K_K01**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Herpetology and mammalogy (herpetologia i teriologia)**			
Format of instruction: **lecture**			
1. **Amphibians and reptiles: origin**	4	1	0
2. **Amphibians and reptiles: reproduction and life histories**	4	2	0
3. **Amphibians and reptiles: physiological ecology**	4	1	0
4. **Amphibians and reptiles: Behavioural ecology**	4	2	0
5. **Amphibians and reptiles: population dynamics and conservation**	4	2	0
6. **Mammals: origins**	4	1	0
7. **Mammals: reproduction and life history**	4	2	0
8. **Mammals: behavioural ecology**	4	2	0
9. **Mammals: population dynamics and conservation**	4	2	0

Format of instruction: **discussion classes**			
1. **Classification and diversity: Caecilians**	4	1	0
2. **Classification and diversity: Caudata**	4	2	0
3. **Classification and diversity: Anura**	4	2	0
4. **Classification and diversity: Turtles**	4	2	0
5. **Classification and diversity: Crocodylians**	4	2	0
6. **Classification and diversity: Tuataras and Lizards**	4	1	0
7. **Classification and diversity: Snakes**	4	1	0
8. **General classification and diversity of mammals with the distinction of mammals in aquatic environments**	4	4	0

Modes of delivery	**prezentacja multimedialna, opracowanie projektu, praca w grupach**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2**
	SPRAWDZIAN	**EP1,EP2**
	PROJEKT	**EP1,EP2,EP3**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	
	- writing test **- performance of a final work: slides** **- the final credit based on partial credits received during the semester for specific activities (partial tests covering the knowledge of the lectures and recommended literature, completion of classes, presentation and tests)**
	Grade calculation principles
	The final grade will be calculated as an average of the grades (1:1) acquired by the student.

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	4	Herpetology and mammalogy (herpetologia i teriologia)		Arytmetyczna	
	4	Herpetology and mammalogy (herpetologia i teriologia) [ćwiczenia]	zaliczenie z oceną		
	4	Herpetology and mammalogy (herpetologia i teriologia) [wykład]	zaliczenie z oceną		

Basic reading	
	Annalisa Berta, James L. Sumich, Kit M. Kovacs (2005): Marine Mammals - Evolutionary Biology, Academic Press
	Donald W. Linzey (2004): Vertebrate Biology, McGraw Hill Higher Education, Europe
	George R. Zug, Laurie J. Vitt, Janalee P. Caldwell (2001): An Introductory Biology of Amphibians and Reptile, Academic Press
Supplementary reading	Thomas A. Jefferson, Stephen Leatherwood, Marc A. Webber (1993): Marine Mammals of the World, FAO and UNEP, Rzym

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**30**	**0**
Participation in test / exam	**4**	**0**
Preparation for contact hours	**15**	**0**

Private reading and studying	**5**	**0**
Participation in tutorials	**4**	**0**
Preparation of project / essay / etc.	**8**	**0**
Preparation for test / exam	**9**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Ichthyology (ichtiologia) (KIERUNKOWE)**	Course code: **SPR201AIJ3450_1S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 3 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	discussion classes	20	0	pg	3
		lecture	20	0	pg	
Total			**40**			**3**

Course / module coordinator	**prof. dr hab. inż. ROBERT CZERNIAWSKI**
Course instructor	**prof. dr hab. inż. ROBERT CZERNIAWSKI**
Course / module objectives	**The aim of the course is to familiarize students with the systematics, taxonomy and biology of fish. After completing the course the student is able to identify the most important species and taxonomic groups of fish.**
Prerequisites	**Basic knowledge of biology**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**The student knows and understands at an advanced level selected facts, concepts and theories, which are the basic general knowledge in the field of natural sciences, forming the theoretical foundations of ichthyology**	**K_W01**
	2	**EP2**	**The student knows and understands the basic research and laboratory methods and techniques used in contemporary ichthyology**	**K_W02**
	3	**EP3**	**The student knows and understands at an advanced level the relationships of ichthyology with other natural disciplines, enabling the understanding of the principles of the functioning of organisms and the interpretation and generalization of knowledge**	**K_W03**
skills	**1**	**EP4**	**The student is able to properly select and use sources of scientific information, critically analyze and evaluate them, and perform data synthesis to formulate and solve problems**	**K_U02**
	2	**EP5**	**The student is able to properly select and use appropriate research methods and tools, and present the results of observations and conclusions, including the analysis of professional literature, in written and oral form, using advanced information and communication techniques**	**K_U03**
	3	**EP6**	**The student is able to carry out observations and measurements using appropriate research and laboratory tools and methods, as well as interpret the obtained results and draw conclusions based on his knowledge**	**K_U04**

social competences	**1**	**EP7**	**The student is ready to critically assess his knowledge and received content and to recognize the importance of general and specialist knowledge in the field of ichthyology in solving cognitive and practical problems, and to consult with experts the difficulties with solving problems on his own.**	**K_K02**
	2	**EP8**	**The student is ready to fulfill social obligations, including sharing knowledge in the field of ichthyology with others and co-organizing activities for the social environment.**	**K_K03**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Ichthyology (ichtiologia)**			
Format of instruction: **lecture**			
1. **Fish systematics**	3	5	0
2. **Adaptation of fish to life in a diversified aquatic environment**	3	3	0
3. **Migratory and sedentory fish**	3	3	0
4. **Fish reproduction**	3	3	0
5. **Development and growth in early ontogenesis.**	3	3	0
6. **Species protection of fish**	3	3	0
Format of instruction: **discussion classes**			
1. **Identifying fish species**	3	2	0
2. **Morphological and anatomical structure of fish, cartilaginous fish**	3	3	0
3. **Morphological and anatomical structure of fish, bone skeleton fish**	3	3	0
4. **Methods for determining the age of fish**	3	3	0
5. **The structure and growth of gonads and the cycle of annual development of the gonads.**	3	3	0
6. **Methods of determining the stages of gonad development**	3	3	0
7. **Development of fish in artificial conditions**	3	3	0

Modes of delivery	**macroscopic and microscopic observation, drawings, multimedia presentation**	
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.	
Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP3,EP4,EP7**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP5,EP6,EP7,EP8**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	
Grading criteria	**The condition for obtaining credit for the exercises is a positive grade, which is the average grade obtained from the test verifying the mastery of the knowledge provided to the student in the course of the exercises. The condition for obtaining a credit for the lecture is a positive grade from the test verifying the mastery of the knowledge passed to the student during the lectures.**	
	Grade calculation principles	
	Average of the final grade for exercises and lectures.	

	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
Final grade calculation method	3	Ichthyology (ichtiologia)		Arytmetyczna	
	3	Ichthyology (ichtiologia) [ćwiczenia]	zaliczenie z oceną		
	3	Ichthyology (ichtiologia) [wykład]	zaliczenie z oceną		
Basic reading	Helfman, G., Collette, B. B., Facey, D. E., Bowen, B. W. (2009): The diversity of fishes: biology, evolution, and ecology. , John Wiley & Sons.				
Supplementary reading					

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**40**	**0**
Participation in test / exam	**5**	**0**
Preparation for contact hours	**5**	**0**
Private reading and studying	**10**	**0**
Participation in tutorials	**5**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**10**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Microbiology of the aquatic environment (mikrobiologia środowiska wodnego) (PODSTAWOWE)**	Course code: **SPR201AIJ3450_11S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 3 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	laboratory	30	0	pg	5
		lecture	30	0	e	
Total			**60**			**5**

Course / module coordinator	**dr hab. PAULINA NIEDŹWIEDZKA-RYSTWEJ**
Course instructor	**dr hab. PAULINA NIEDŹWIEDZKA-RYSTWEJ**
Course / module objectives	**Acquainting with the structure and physiology of microorganisms, including environmental ones, and demonstrating the role of microorganisms in environment. Acquire skills of performing laboratory test in environmental microbiology. Learning to plan, execute, and learn from an experiment. Independent and group work.**
Prerequisites	**Knowledge of cell structure. Basic manual skills. Ability to work in team.**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	**The student describes the morphological and physiological features of bacteria, with particular emphasis on those that affect their use in the environment.**	**K_W01 K_W03**
	2	EP2	**The student knows the structure and characteristics of viruses (bacteriophages) and fungi.**	**K_W04**
	3	EP3	**Has knowledge of bacteria, viruses and fungi performing bioindication functions. Describes the role of microorganisms in biogeochemical cycles and biodegradation.**	**K_W01 K_W06**
	4	EP4	**Knows selected methods, techniques and research tools used in microbiology of the aquatic environment.**	**K_W02 K_W08**
skills	1	EP5	**Can plan and execute an experiment with using basic microbiological methods.**	**K_U03**
	2	EP6	**Uses available sources of information, including electronic ones, to obtain, collect and process data from various fields of knowledge related to hydrobiology.**	**K_U02**
	3	EP7	**Performs alone or in a team, under the supervision of a research supervisor, simple research tasks and expert opinions as well as tasks in the field of hydrobiology, noticing their microbiological aspects.**	**K_U04 K_U07**
social competences	1	EP8	**Understands the need for continuous training in the field environmental microbiology.**	**K_K05**
	2	EP9	**Is aware of the influence of microorganisms on shaping the natural environment.**	**K_K02**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Microbiology of the aquatic environment (mikrobiologia środowiska wodnego)**			
Format of instruction: **lecture**			
1. **Characteristics of bacteria; their morphological properties; physiology: growth and reproduction. Metabolic processes of microorganisms in the environmental aspect. Application microorganisms in environmental protection. Ecology of microorganisms and bacterial variability.**	3	10	0
2. **Structure and physiology of viruses (bacteriophages) and fungi in waters.**	3	8	0
3. **Biological characteristics of the more important groups of microorganisms, i.e. bacteria, viruses and fungi, with particular emphasis on species with bioindication functions. Role microorganisms in biogeochemical and biodegradation cycles, i.e. the participation of microorganisms in changes in the environment.**	3	12	0
Format of instruction: **laboratory**			
1. **Methods of identifying microorganisms**	3	12	0
2. **Microbiology of waters. Methods of assessing these environments with particular water (bacteria of physiological groups, sanitary bacteria, bacteriophages FRNA and FDNA). Microbiological analysis of water samples taken from selected water reservoirs.**	3	18	0

Modes of delivery	**multimedia presentation, group work, practical classes**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	EGZAMIN PISEMNY	**EP1,EP2,EP3,EP4**
	KOLOKWIUM	**EP1,EP2,EP3,EP4**
	PRACA PISEMNA/ ESEJ/ RECENZJA	**EP1,EP2,EP3,EP4,EP6**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP5,EP7,EP8,EP9**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**Exam - written test concerning the knowledge of the lectures; passing laboratories on the basis of activity, and written tests**
	Grade calculation principles
	The final grade is 75% of the grade for the written lectures and 25% of the grade for the laboratories.

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	Microbiology of the aquatic environment (mikrobiologia środowiska wodnego)		Ważona	
	3	Microbiology of the aquatic environment (mikrobiologia środowiska wodnego) [laboratorium]	zaliczenie z oceną		0,25
	3	Microbiology of the aquatic environment (mikrobiologia środowiska wodnego) [wykład]	egzamin		0,75

Basic reading	Baj J., Markiewicz Z. (2005): Biologia molekularna bakterii., Wyd. Nauk. PWN, Warszawa
	Bergey D.H., Harrison F.C., Breed R.S., Hammer B.W., Huntoon F.M. (2009): Bergey's manual of systematic bacteriology (ed.2)., Wyd. Springer, Nowy Jork
	Błaszczyk M.K. (2010): Mikrobiologia środowisk., Wyd. Nauk. PWN, Warszawa
	Paul E.A., Clark F. E. (2000): Mikrobiologia i biochemia wód., Wyd. UMCS Lublin, Lublin
	Pawlaczyk-Szpilowa M. (1980): Mikrobiologia wody i ścieków., Wyd. Nauk PWN, Warszawa
	Reinheimer G. (1987): Mikrobiologia wód., Wyd. PWRiL, Warszawa
Supplementary reading	

STUDENT WORKLOAD		
	No. of hours	
		including e-learning
Contact hours	**60**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**20**	**0**
Private reading and studying	**10**	**0**
Participation in tutorials	**10**	**0**
Preparation of project / essay / etc.	**3**	**0**
Preparation for test / exam	**20**	**0**
TOTAL workload	**125**	
ECTS credits	**5**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Oceanography (oceanografia) (KIERUNKOWE)**	Course code: **SPR201AIJ3446_20S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 4 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	4	discussion classes	15	0	pg	5
		lecture	15	0	e	
Total			**30**			**5**

Course / module coordinator	**dr hab. ROMAN MARKS**
Course instructor	**dr hab. ROMAN MARKS**
Course / module objectives	**Assimilation of knowledge of oceanography by the student. After completing the course the student is able to apply the techniques and measuring equipment used in oceanography and correctly interpret the obtained results. The student is ready to expand his knowledge and improve professional competences.**
Prerequisites	**Basic knowledge of physics and chemistry**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	knows and understands chemical and physical tools necessary to understand basic laws and natural phenomena	K_W01
	2	EP2	Students know and understand the importance of basic analytical techniques and research tools used in the work of oceanographer to describe and interpret marine environmental processes	K_W02 K_W07
	3	EP3	Know and understand at an advanced level the issues and research problems in the field of oceanography	K_W01
skills	1	EP4	Student is able to operate measuring systems used in oceanographic research	K_U03
	2	EP5	Student is able to carry out experiments and observations using appropriate research methods and interpret the obtained results of observations	K_U04
	3	EP6	Student is able to use scientific terminology and is able to explain the concepts of oceanography	K_U05
social competences	1	EP7	Student is ready to critically assess owned knowledge	K_K02
	2	EP8	Student is ready to use his / her qualifications to initiate actions for the public interest	K_K04

CONTENT	Semester	No. of hours	including e-learning

Subject title: **Oceanography (oceanografia)**

Format of instruction: **lecture**			
1. **History of oceanography**	4	2	0
2. **Instruments used in oceanography**	4	2	0
3. **Thermal, saline and density structures of oceanic water**	4	2	0
4. **Ocean-atmosphere interactions**	4	3	0
5. **Gases dissolved in sea water**	4	2	0
6. **Biogenic matter in oceanic waters**	4	2	0
7. **Bubble mediated formation and functioning of RNA and DNA**	4	2	0
Format of instruction: **discussion classes**			
1. **Measurements of wind waves parameters in the coastal zone**	4	2	0
2. **Observation of wind wave transformation in the coastal zone**	4	2	0
3. **Photography recording of whitecap cover in the coastal water**	4	2	0
4. **Observation of Langmuir circulation**	4	2	0
5. **Photography recording of rotational features generated around bubbles rising in sea water**	4	3	0
6. **Measurements of dissolved oxygen concentration in coastal water**	4	2	0
7. **Experimental observations of droplets produced by bursting bubbles**	4	2	0

Modes of delivery	**Experimental observations conducted in laboratory and in marine coastal zone**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	EGZAMIN USTNY	**EP1,EP2,EP3,EP4,EP6,EP7,EP8**
	SPRAWDZIAN	**EP1,EP2,EP3**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP4,EP5,EP6,EP7,EP8**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**Practical classes: Correct performance of partial tasks, positive evaluation of the tests** **Lecture: a positive evaluation of the oral exam - covering the content of lectures**
	Grade calculation principles
	The final grade for the course is the average of grades from lectures and practical classes in a 1: 1 ratio.

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	4	Oceanography (oceanografia)		Arytmetyczna	
	4	Oceanography (oceanografia) [wykład]	egzamin		
	4	Oceanography (oceanografia) [ćwiczenia]	zaliczenie z oceną		

Basic reading	Knauss J.A. (2005): Introduction to Physical Oceanography , Waveland Pr Inc.
Supplementary reading	Marks R., Górecka E., McCartney K., Borkowski W. (2019): Rising bubbles as mechanism for scavenging and aerosolization of diatoms, Journal of Aerosol Science, Vol. 128, 79-88

STUDENT WORKLOAD		
	No. of hours	
		including e-learning
Contact hours	**30**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**6**	**0**
Private reading and studying	**30**	**0**
Participation in tutorials	**2**	**0**
Preparation of project / essay / etc.	**30**	**0**
Preparation for test / exam	**25**	**0**
TOTAL workload	**125**	
ECTS credits	**5**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**		
Course title: **Ornithology (ornitologia) (KIERUNKOWE)**		Course code: **SPR201AIJ3450_39S**
Name of field of study: **Hydrobiology**		
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic**	Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 3 - english language**	

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	discussion classes	15	0	pg	3
		lecture	15	0	pg	
Total			**30**			**3**

Course / module coordinator	**dr hab. ŁUKASZ JANKOWIAK**
Course instructor	**dr hab. ŁUKASZ JANKOWIAK**
Course / module objectives	**Knowledge about the factors determining the biology of birds. Ability to birds identification and ability to count indicator bird species. The student is aware of the importance of birdlife in nature.**
Prerequisites	**Knowledge of the zoology at the secondary school grade**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**Defines the sources of birds biodiversity, discusses the causes of the biodiversity in terms of time and geography**	**K_W06**
skills	**1**	**EP2**	**Uses the scientific literature**	**K_U02**
social competences	**1**	**EP3**	**Student maintains a fact-based and critical attitude in evaluating his own work**	**K_K01**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Ornithology (ornitologia)**			
Format of instruction: **lecture**			
1. **Origins**	3	3	0
2. **Form and function**	3	3	0
3. **Behaviour and communication**	3	2	0
4. **Behaviour and the environment**	3	2	0
5. **Avian life histories**	3	3	0
6. **Population dynamics and conservation**	3	2	0
Format of instruction: **discussion classes**			
1. **Identification of wetland birds**	3	6	0
2. **Identification of farmland birds**	3	3	0

3. **Identification of urban birds**	3	3	0
4. **Identification of forest birds**	3	3	0

Modes of delivery	**slides presentation, project development, working in groups**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2**
	SPRAWDZIAN	**EP1,EP2**
	PREZENTACJA	**EP1,EP2,EP3**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**- writing test** **- performance of a final work: slides** **- the final credit based on partial credits received during the semester for specific activities (partial tests covering the knowledge of the lectures and recommended literature, completion of classes, presentation and tests)**
	Grade calculation principles
	The final grade will be calculated as an average of the grades (1:1) acquired by the student.

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	Ornithology (ornitologia)		Arytmetyczna	
	3	Ornithology (ornitologia) [ćwiczenia]	zaliczenie z oceną		
	3	Ornithology (ornitologia) [wykład]	zaliczenie z oceną		

Basic reading	Frank B. Gill (2007): Ornithology (Third Edition), W. H. Freeman and Company, New York
	Lars Svensson; Killian Mullarney; Dan Zetterstro?m; P J Grant (2009): Collins bird guide, Collins, London
Supplementary reading	E.A. Schreiber, Joanna Burger (2002): Biology of Marine Birds, CRC Press, Boca Raton, London, New York, Washington D.C.

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**30**	**0**
Participation in test / exam	**4**	**0**
Preparation for contact hours	**15**	**0**
Private reading and studying	**5**	**0**
Participation in tutorials	**4**	**0**
Preparation of project / essay / etc.	**8**	**0**
Preparation for test / exam	**9**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Phycology (fykologia) (KIERUNKOWE)**	Course code: **SPR201AIJ3446_22S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 4 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	4	laboratory	30	0	pg	6
		lecture	30	0	e	
Total			**60**			**6**

Course / module coordinator	**dr ROMAIN GASTINEAU**
Course instructor	**dr ROMAIN GASTINEAU**
Course / module objectives	**The aim of the course is to understand the key issues of the morphology, classification, ecology and ecophysiology of algae and seagrass, algae phylogeny and genomics, harmful algal blooms, assessment of the ecological quality of coastal waters using macrophytes as biomarkers, applied phycology and commercial algae. Students will be able to classify and recognise basic types of algae.**
Prerequisites	**Knowledge and skills acquired in courses such as Botany and Ecology are recommended.**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	**knows and understands research and field techniques used in phycology**	**K_W02**
	2	EP2	**Knows and understands the principles of preserving biodiversity in the context of obtaining algae and marine plants for economic purposes**	**K_W04**
skills	1	EP3	**is able to properly plan phycological sampling methods and identify the main groups of algae and marine plants**	**K_U04**
	2	EP4	**is able to search for information on the identified organisms and associate their occurrence with specific environmental conditions**	**K_U02**
social competences	1	EP5	**it is ready to balance the need to conserve biodiversity with the need to exploit the living resources of the seas and the oceans**	**K_K01**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Phycology (fykologia)**			
Format of instruction: **lecture**			
1. **Introduction to phycology.**	4	4	0
2. **Cyanobacteria, formerly the blue lineage.**	4	4	0
3. **Macroalgae.**	4	4	0
4. **The vast world of microalgae, part 1.**	4	4	0

5. **The vast world of microalgae, part 2.**	4	4	0
6. **Aquaculture and blue biotechnologies**	4	4	0
7. **The use of genomics in phycology**	4	4	0
8. **Algae and biomonitoring.**	4	2	0
Format of instruction: **laboratory**			
1. **Establishing a culture collection of microalgae.**	4	4	0
2. **Taxonomy of algae.**	4	4	0
3. **Molecular biology and genomics applied to algae part 1**	4	6	0
4. **Molecular biology and genomics applied to algae part 2**	4	6	0
5. **Molecular biology and genomics applied to algae part 3**	4	6	0
6. **Molecular biology and genomics applied to algae part 4**	4	4	0

Modes of delivery	**Lecture based on the original script in the form of multimedia presentations. Laboratory exercises in the form of tasks to be performed with the use of optical equipment - microscopes and binoculars or, if carried out online, with the use of photos, figures and databases.**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	EGZAMIN USTNY	**EP1,EP2**
	KOLOKWIUM	**EP3,EP4**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP5**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**Performing correctly all laboratory tasks and passing a test in laboratories, as well as obtaining a positive exam grade in the lectures.**
	Grade calculation principles
	The final grade is the average of the grades from exercises and the exam.

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	4	Phycology (fykologia)		Arytmetyczna	
	4	Phycology (fykologia) [laboratorium]	zaliczenie z oceną		
	4	Phycology (fykologia) [wykład]	egzamin		

Basic reading	Lee R.E. (1999): Phycology, Cambridge Univ. Press, Cambridge
	van den Hoek C., Mann D.G., Jahns H.M. (1995): Algae. An introduction to phycology, Cambridge Univ. Press, Cambridge
Supplementary reading	powierzone na bieżąco materiały w postaci artykułów i książek :

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**60**	**0**
Participation in test / exam	**4**	**0**
Preparation for contact hours	**20**	**0**

Private reading and studying	**25**	**0**
Participation in tutorials	**25**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**16**	**0**
TOTAL workload	**150**	
ECTS credits	**6**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Physiology of water animals (fizjologia zwierząt wodnych) (KIERUNKOWE)**	Course code: **SPR201AIJ3450_23S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 4 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	4	laboratory	15	0	pg	3
		lecture	15	0	pg	
Total			**30**			**3**

Course / module coordinator	**dr hab. WIOLETA DUDZIŃSKA**
Course instructor	**dr hab. WIOLETA DUDZIŃSKA**
Course / module objectives	**Understanding the relationship between the course of life activities of aquatic animals and the environmental factors, which, as a result, will allow us to understand the behavioral and physiological adaptations to life in various aquatic habitats. Students will be able to perform analyze the course of physiological processes conditioning the functioning of animals in the aquatic environment, be responsible for jointly performed tasks.**
Prerequisites	**Basic knowledge of the biology of aquatic animals.**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**The student has knowledge of the basic physiological processes of aquatic animals. Knows and understands their regulation and connections enabling the maintenance of homeostasis, as well as the adaptation of animals to their living environment.**	**K_W01 K_W06**
skills	**1**	**EP2**	**The student is able to use his knowledge to analyze the course of physiological processes conditioning the functioning of animals in the aquatic environment. Uses basic techniques and methods to obtain physiological and environmental data and is able to link them with each other. Can plan and organize work independently and in a team in order to effectively perform specific tasks.**	**K_U01 K_U03 K_U04 K_U07**
social competences	**1**	**EP3**	**The student knows the limitations of his own knowledge and skills and understands the need to constantly improve professional qualifications, as well as personal and social competences, is ready to perform various roles in a team, submit to the rules of teamwork and be responsible for jointly performed tasks.**	**K_K01 K_K02**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Physiology of water animals (fizjologia zwierząt wodnych)**			
Format of instruction: **lecture**			
1. **Water as the habitat of animals. Mechanisms underlying adaptation to life.**	4	2	0

2. **Animal water balance, osmoregulation and excretion. Adaptations to life in fresh and salt waters.**	4	2	0
3. **Adaptations of the cardiovascular and respiratory systems to life in aquatic environments: animal respiration without specialized respiratory organs, respiratory organs of aquatic animals, respiration and gas exchange mechanism.**	4	3	0
4. **Thermal adaptations of aquatic organisms in different habitats: physiological effects of temperature change, temperature regulation in cold and warm conditions, thermal conductivity.**	4	2	0
5. **Different forms of adaptation of aquatic animals to the nutrition process: food intake, symbiotic food supply, digestion - intra- and extracellular, food intake regulation and energy demand.**	4	2	0
6. **The impact of environmental conditions on the structure and functioning of the sensory organs, the nervous and endocrine systems. Circadian and seasonal rhythms in animals as a direct requirement of the environment.**	4	2	0
7. **Physiological and behavioral adaptations to extreme aquatic habitats.**	4	2	0
Format of instruction: **laboratory**			
1. **Measuring plasma osmolality in fish acclimated to different salinities.**	4	3	0
2. **Physiology of the cardiovascular and circulatory system of fish. Heart function. Taking blood samples, making and staining smears and their microscopic analyses.**	4	3	0
3. **Respiration in fish- determining the level of oxygen dissolved in water and determining the influence of temperature on the respiration process.**	4	3	0
4. **Functions of the excretory system - determination of the content of ammonium ion and ammonia in water.**	4	3	0
5. **Anatomical and physiological differences in the digestive systems of predatory fish and planktivores. Digestive enzymes.**	4	3	0

Modes of delivery	**Lecture** **Labs**	
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.	
Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP1,EP2,EP3**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	
Grading criteria	**Lectures: test composed of single-choice questions. In order to get the mark 3,0 the student must give 60% of correct answers.** **Labs: test composed of single-choice questions. In order to get the mark 3,0 the student must give 60% of correct answers.**	
	Grade calculation principles	
	The overall grade is calculated as a mean average of grades obtained during lectures and labs.	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	4	Physiology of water animals (fizjologia zwierząt wodnych)		Arytmetyczna	
	4	Physiology of water animals (fizjologia zwierząt wodnych) [wykład]	zaliczenie z oceną		
	4	Physiology of water animals (fizjologia zwierząt wodnych) [laboratorium]	zaliczenie z oceną		

Basic reading	Baldisserotto B., Mancera Romero J.M. , Kapoor B.G (1997): Fish Osmoregulation, Science Publishers
	Schmidt-Nelsen K (1997): Animal Physiology: Adaptation and Environment, 5th Edition., Cambridge University Press
	Willmer P., Stone G., Johnston I. (2004): Environmental Physiology of Animals, 2nd Edition. , Wiley-Blackwell
Supplementary reading	

STUDENT WORKLOAD		
	No. of hours	
		including e-learning
Contact hours	**30**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**18**	**0**
Private reading and studying	**15**	**0**
Participation in tutorials	**0**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**10**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Physiology of water plants (fizjologia roślin wodnych) (KIERUNKOWE)**	Course code: **SPR201AIJ3450_15S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 3 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	laboratory	30	0	pg	3
		lecture	15	0	pg	
Total			**45**			**3**

Course / module coordinator	**dr DANUTA CEMBROWSKA-LECH**
Course instructor	**dr DANUTA CEMBROWSKA-LECH**
Course / module objectives	**The aim of the course is to present the basic life processes and functioning of water plants, regulatory mechanisms during plant growth and development and the influence of environmental factors on these processes. The students know and use basic biochemical methods. Students are ready to use knowledge and information to solve problems related to the functioning of plants.**
Prerequisites	**Students should have a basic knowledge of structure and properties of organic compounds, plant cell and tissues structure, together with the ability of working in a chemical laboratory.**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	**Student has a basic knowledge of biochemical and physiological processes in water plants.**	**K_W01 K_W06**
	2	EP2	**Student knows the principle of mechanisms that regulate the general vital functions of water plants.**	**K_W01 K_W03**
	3	EP3	**Student knows the basic methods, techniques, tools and materials used to solve simple tasks in the field of study.**	**K_W02 K_W07**
skills	1	EP4	**Student is able to evaluate and interpret the basic biological parameters of plants in order to diagnose the physiological and biochemical status of water plants.**	**K_U02**
	2	EP5	**Student is able to plan and perform experiments related to the assessment of physiological processes in plants.**	**K_U03 K_U04**
	3	EP6	**Student analyzes the conditions of physiological processes in plant organisms in terms of the possibility of their optimization.**	**K_U02 K_U03 K_U04**
	4	EP9	**Student is able to work individually and in a group, assuming different roles in it, aiming to achieve the assumed goal.**	**K_U07**
	5	EP10	**Is able to properly define priorities in order to accomplish a task defined by himself or others.**	**K_U08**
social competences	1	EP8	**Is aware of the level of their knowledge and skills and understands the need for lifelong learning.**	**K_K02**

CONTENT	Semester	No. of hours	including e-learning

Subject title: **Physiology of water plants (fizjologia roślin wodnych)**			
Format of instruction: **lecture**			
1. **Introduction to physiology of water plant. Mineral nutrition.**	3	3	0
2. **Solute transport.**	3	2	0
3. **Respiration.**	3	2	0
4. **Photosynthesis.**	3	4	0
5. **Phytohormones in the regulation of physiological processes.**	3	2	0
6. **Stress physiology.**	3	2	0
Format of instruction: **laboratory**			
1. **Chemical analysis of plant material.**	3	4	0
2. **Water and mineral management.**	3	4	0
3. **Determination of the assimilation pigments level.**	3	4	0
4. **Photosynthesis intensity - influence of external factors.**	3	4	0
5. **Respiration intensity - influence of external factors.**	3	4	0
6. **Influence of phytohormones on plant growth and development.**	3	6	0
7. **Plant resistance to stress.**	3	4	0

Modes of delivery	**Lecture- multimedia presentations.** **Lab- group work and independent work, carrying out experiments laboratory.**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP4,EP6,EP8**
	SPRAWDZIAN	**EP1,EP2,EP4,EP8**
	PROJEKT	**EP1,EP10,EP2,EP3,EP4,EP6,EP8,EP9**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP1,EP10,EP2,EP3,EP4,EP5,EP6,EP9**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**Lecture- written exam.** **Lab- Activity in class, passing a test and reports on observation and discussing the results of the experiments.**
	Grade calculation principles
	The final grade of the course coordinator is calculated as the arithmetic mean of the grades from laboratory exercises and lectures.

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	Physiology of water plants (fizjologia roślin wodnych)		Arytmetyczna	
	3	Physiology of water plants (fizjologia roślin wodnych) [laboratorium]	zaliczenie z oceną		
	3	Physiology of water plants (fizjologia roślin wodnych) [wykład]	zaliczenie z oceną		

Basic reading	Lincoln Taiz, Eduardo Zeiger, Ian M. M?ller, and Angus Murphy (2018): Plant Physiology and Development, Sinauer Associates, Oxford University Press
	Neil Willey (2016): Environmental Plant Physiology, Garland Science, NY

Supplementary reading	Bhatla, Satish C, Lal, Manju A (2018): Plant Physiology, Development and Metabolism, Springer Nature
	Dhir, Bhupinder (2013): Phytoremediation: Role of Aquatic Plants in Environmental Clean-Up, Springer Nature
	Lambers, Hans, Oliveira, Rafael (2019): Plant Physiological Ecology, Springer Nature

STUDENT WORKLOAD		
	No. of hours	
		including e-learning
Contact hours	**45**	**0**
Participation in test / exam	**4**	**0**
Preparation for contact hours	**4**	**0**
Private reading and studying	**4**	**0**
Participation in tutorials	**7**	**0**
Preparation of project / essay / etc.	**5**	**0**
Preparation for test / exam	**6**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Potamology and limnology (potamologia i limnologia) (KIERUNKOWE)**	Course code: **SPR201AIJ3450_13S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 3 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	discussion classes	30	0	pg	6
		lecture	30	0	e	
Total			**60**			**6**

Course / module coordinator	**prof. dr hab. inż. ROBERT CZERNIAWSKI**
Course instructor	**prof. dr hab. inż. ROBERT CZERNIAWSKI**
Course / module objectives	**The aim of the course is to familiarize students with the functioning of natural freshwater basins, both standing and flowing. After completing the course, the student has knowledge of the most important phenomena that determine the proper functioning of standing and running waters. Student is able to assess the condition of properly functioning river and lake ecosystems. Is aware of the effects of human activity on the functioning of watercourses.**
Prerequisites	**Basic knowledge of biology**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**The student understands the specificity of the functioning of running and standing waters**	**K_W01**
	2	**EP2**	**The student understands the specificity of the functioning of running and standing waters**	**K_W03**
	3	**EP3**	**The student has knowledge of mathematics, physics and chemistry to understand the natural phenomena occurring in running and standing waters, knows the techniques and tools needed to assess the environment of flowing and stagnant waters**	**K_W02 K_W07**
skills	**1**	**EP4**	**The student is able to plan and perform analyzes using the research techniques and methods in the assessment of the environment of running and standing waters. Te student based on the known methods can predict the environmental conditions of the river in relation to the current state of the environment**	**K_U01 K_U04**
	2	**EP5**	**The student acquires the skills to recognize and explain the phenomena related to the functioning of river ecosystems using the available information sources**	**K_U03**
	3	**EP6**	**The student performs simple tasks, alone or in a team and under the supervision of a tutor. He can make a critical assessment of the functioning and usefulness of technical solutions used in the protection of water basins environment**	**K_U07**

social competences	**1**	**EP7**	**The student is ready to cooperate with the community, institutions and entrepreneurs for the protection of the aquatic environment.**	**K_K03**
	2	**EP8**	**The student is ready to constantly update his knowledge in the field of improving the condition of natural waters**	**K_K06**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Potamology and limnology (potamologia i limnologia)**			
Format of instruction: **lecture**			
1. **Properties and types of running waters**	3	2	0
2. **Biological resources and interactions in running waters**	3	2	0
3. **Circulation of inorganic and organic matter in running waters**	3	2	0
4. **Biocenosis of running waters**	3	2	0
5. **The meaning of flow-through basins in funkctioning of running waters**	3	2	0
6. **River Continuum Concept**	3	2	0
7. **Properties and types of standing waters**	3	2	0
8. **Lake eutrophication**	3	2	0
9. **Biological resources and interactions in standing waters**	3	2	0
10. **Circulation of inorganic and organic matter in standing waters**	3	2	0
11. **Biocenosis of standing waters**	3	2	0
12. **Funkcjonowanie i rola mokradeł w prawidłowym utrzymaniu stosunków wodnych**	3	2	0
13. **River-lake ecotones**	3	2	0
14. **Astatic basins**	3	2	0
15. **Transitional waters**	3	2	0
Format of instruction: **discussion classes**			
1. **Predictability of the environmental conditions of runnig waters based on the knowledge of the current abiotic state**	3	2	0
2. **The role of flow-through basins as clarifiers of organic matter in rivers**	3	2	0
3. **Inter-structural connections in river**	3	2	0
4. **Assessment of the driffted organic matter mass on the river ecosystem functioning**	3	2	0
5. **The role of morphometric indicators of running waters and river valleys in the context of ecosystem features**	3	2	0
6. **Designing the biological assumptions in the protection of river habitats and organisms**	3	2	0
7. **Predictability of the environmental conditions of standing waters based on the knowledge of the current abiotic state**	3	2	0
8. **The role of morphometric indicators of standing waters and river valleys in the context of ecosystem features**	3	2	0
9. **Morphometric characteritics of lakes**	3	2	0
10. **Ecological zones of lakes and the role of macrophytes in shaping the ecological conditions of standing waters**	3	2	0
11. **Physico-chemical properties of the water and sediments of lakes**	3	2	0
12. **Diel migrations of aquatic organisms**	3	4	0
13. **Assessment of the use of catchment area on the standing waters functioning**	3	2	0
14. **Assessment of the use of catchment area on the running waters functioning**	3	2	0

Modes of delivery	**group work, independent calculations, multimedia presentation**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	EGZAMIN USTNY	**EP1,EP3,EP4,EP8**
	KOLOKWIUM	**EP2,EP7,EP8**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP5,EP6**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**The condition for obtaining credit for the exercises is a positive grade, which is the average grade obtained from the test verifying the mastery of the knowledge provided to the student during the exercises. The condition for obtaining a credit for the lecture is a positive grade from the oral exam verifying the mastery of the knowledge passed to the student during the lectures.**
	Grade calculation principles
	Average of the final grade for exercises and lectures

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	Potamology and limnology (potamologia i limnologia)		Arytmetyczna	
	3	Potamology and limnology (potamologia i limnologia) [ćwiczenia]	zaliczenie z oceną		
	3	Potamology and limnology (potamologia i limnologia) [wykład]	egzamin		

Basic reading	Allan, J. D., Castillo, M. M. (2007): Stream ecology: structure and function of running waters. , Springer Science & Business Media.
	J.G. Tundisi, T. Matsumura-Tundisi (2012): Limnology, Taylor & Francis
Supplementary reading	

STUDENT WORKLOAD

	No. of hours	including e-learning
Contact hours	**60**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**20**	**0**
Private reading and studying	**18**	**0**
Participation in tutorials	**25**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**25**	**0**
TOTAL workload	**150**	
ECTS credits	**6**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**	
Course title: **Statistics (statystyka) (PODSTAWOWE)**	Course code: **SPR201AIJ3450_12S**
Name of field of study: **Hydrobiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 3 - english language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	konwersatorium	30	0	pg	2
Total			**30**			**2**

Course / module coordinator	**dr hab. ŁUKASZ JANKOWIAK**
Course instructor	**dr hab. ŁUKASZ JANKOWIAK**
Course / module objectives	**The aim is to introduce a number of basic concepts and techniques that should allow the student to get started with practical statistics. Acquiring practical skills to use the statistical software R. The student is ready to solve environmental problems using statistical analyzes.**
Prerequisites	**Knowledge of the mathematics at the secondary school grade**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**Student knows the basic statistical methods used in hydrobiology**	**K_W02**
	2	**EP2**	**knows and understands the basics of mathematical and statistical methods and information technologies that enable the proper description and analysis of processes at various levels of the organization of the living world**	**K_W08**
skills	**1**	**EP3**	**Student can interpret the obtained statistical results and draw conclusions based on their knowledge**	**K_U04**
social competences	**1**	**EP4**	**Student is aware of limitation of statistical solutions and the limitation of obtained data to describing biological complexity**	**K_K01 K_K02**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Statistics (statystyka)**			
Format of instruction: **konwersatorium**			
1. **R language essentials**	3	2	0
2. **Probability and distributions**	3	2	0
3. **One- and two-sample tests**	3	2	0
4. **Regression and correlation**	3	2	0
5. **ANOVA and Kruskal-Wallis**	3	2	0
6. **Tabular data**	3	2	0
7. **Power and the computation of sample size**	3	2	0

8. **Limitations of Linear Regression Applied on Ecological Data**	3	2	0
9. **Things Are Not Always Linear; Additive Modelling**	3	2	0
10. **Mixed Effects Modelling**	3	2	0
11. **GLM and GAM for Count Data**	3	3	0
12. **GLM and GAM for Absence-Presence and Proportional Data**	3	2	0
13. **Zero-Truncated and Zero-Inflated Models for Count Data**	3	2	0
14. **Ordination analysis**	3	3	0

Modes of delivery	**the examples of statistical solutions, multimedia slides, using of R statistical software**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP3,EP4**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP1,EP2,EP3,EP4**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**The basis of the credit is the positive grade obtained by the student in the practical test of R software use to solve the given problem.**
	Grade calculation principles
	The final grade for the course is the grade from discussion classes .

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	Statistics (statystyka)		Ważona	
	3	Statistics (statystyka) [konwersatorium]	zaliczenie z oceną		1,00

Basic reading	Alain F. Zuur, Elena N. Ieno, Neil J. Walker, Anatoly A. Saveliev, Graham M. Smith (2009): Mixed Effects Models and Extensions in Ecology with R, Springer, NY, USA
	Peter Dalgaaard (2002): Introductory Statistics with R, Springer, Denmark
Supplementary reading	W. N. Venables, D. M. Smith and the R Development Core Team (2002): An Introduction to R. Notes on R: A Programming Environment for Data Analysis and Graphics, R Development Core Team.

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**30**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**6**	**0**
Private reading and studying	**3**	**0**
Participation in tutorials	**2**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**7**	**0**
TOTAL workload	**50**	
ECTS credits	**2**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-H-O-I-S-24/25Z**						
Course title: **Water resource management (gospodarowanie zasobami wodnymi) (KIERUNKOWE)**					Course code: **SPR201AIJ3450_26S**	
Name of field of study: **Hydrobiology**						
Mode and cycle of study: **first-degree, full - time**		Profile of study: **general academic**		Specialty:		
Course / module status **obligatory**		Language of instruction: **semester: 4 - english language**				
Year	**Semester**	**Form of instruction**	**No. of hours**		**Type of credit**	**ECTS**
				including e-learning		
2	4	konwersatorium	15	0	pg	5
		lecture	15	0	pg	
		zajęcia terenowe	15	0	pg	
Total			**45**			**5**
Course / module coordinator	**dr hab. ŁUKASZ SŁUGOCKI**					
Course instructor	**dr hab. ŁUKASZ SŁUGOCKI**					
Course / module objectives	**The aim of the course is to familiarize students with issues related to water management. After completing the course, the student is able to define threats to water resources, know the methods of their protection and treatment, understand the causes of floods, and know methods of preventing their negative effects. The student is ready to take conscious actions in the field of rational use and shaping of water resources.**					
Prerequisites	**Basic knowledge of geography, chemistry, physics, and biology.**					

LEARNING OUTCOMES

Category	**No.**	**Code**	**Description**	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**knows and understands at an advanced level selected facts, concepts and phenomena related to water resources management**	**K_W01**
	2	**EP2**	**knows and understands the basic research methods enabling the effective management of water resources**	**K_W02**
	3	**EP3**	**knows the relationship of hydrobiology with other natural disciplines, enabling the understanding of the principles of water resources management**	**K_W03**
	4	**EP4**	**knows and understands at an advanced level the current directions of water resources management**	**K_W05**
skills	**1**	**EP5**	**is able to use the acquired knowledge to solve complex and unusual problems related to water management**	**K_U01**
	2	**EP6**	**is able to properly select and use sources of scientific information, critically analyzing them**	**K_U02**
	3	**EP7**	**is able to properly select and apply appropriate research methods and tools as well as present the results of experiments or observations and conclusions, including the analysis of professional literature**	**K_U03**
	4	**EP8**	**is able to carry out experiments, observations and measurements using appropriate tools and research methods, as well as interpret the obtained results and draw conclusions based on their knowledge**	**K_U04**

social competences	**1**	**EP9**	**is ready to disseminate models of proper conduct in the work environment and outside it, make independent decisions, critically evaluate the activities of its own and of teams and organizations that affect water management**	**K_K01**
	2	**EP10**	**is ready to critically assess the knowledge and content received and to recognize the importance of general and specialist knowledge in the field of hydrobiology in solving problems related to water resources management**	**K_K02**
	3	**EP11**	**is ready to fulfill social obligations, including co-organizing activities for rational water management**	**K_K03**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Water resource management (gospodarowanie zasobami wodnymi)**			
Format of instruction: **lecture**			
1. **Water resources (surface water, underground water, drainage basin), threats to water resources (changes in the amount of water resources), sources of water pollution and changes in the water quality.**	4	2	0
2. **The use of water, its use in economy, tools for the protection of water resources.**	4	2	0
3. **Actions to maintain good water status (reclamation, revitalization, renaturation, ecohydrology).**	4	2	0
4. **Treatment plants and other installations used in water restoration.**	4	2	0
5. **Use of waters in aquaculture, fisheries and angling.**	4	2	0
6. **Flood prevention and water transport.**	4	2	0
7. **Water conflicts.**	4	2	0
8. **Climate changes and water resources.**	4	1	0
Format of instruction: **konwersatorium**			
1. **Interpretation of the results of water status assessment (trophic indexes; river, lake, and catchment indicators) for the purposes of making decisions in water resources management**	4	2	0
2. **Calculation of the effective dose of coagulant for lake reclamation, calculation of the amount of fish for restocking for effective biomanipulation**	4	2	0
3. **Water for recreation; the effects of excessive eutrophication; observations of cyanobacteria, including potentially toxic species; blooms of cyanobacteria in bathing waters.**	4	2	0
4. **Observations of organisms living in the activated sludge, evaluation of the activated sludge condition.**	4	4	0
5. **An experiment with the use of a coagulant and sorption materials in water restoration.**	4	5	0
Format of instruction: **zajęcia terenowe**			
1. **Examples of water use and water resource management.**	4	15	0

Modes of delivery	**microscopic observation, drawings, multimedia presentation, report**	
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.	
Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP3,EP4**
	PRACA PISEMNA/ ESEJ/ RECENZJA	**EP1,EP2,EP3,EP4,EP5,EP6**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP10,EP11,EP5,EP6,EP7,EP8,EP9**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**The condition for obtaining credit is a positive grade obtained during the tutorials and a test verifying the mastery of the knowledge passed to the student in the course of the lectures and passing the field report.**
	Grade calculation principles
	Arithmetic mean of practical classes, lectures and field classes

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	4	Water resource management (gospodarowanie zasobami wodnymi)		Arytmetyczna	
	4	Water resource management (gospodarowanie zasobami wodnymi) [konwersatorium]	zaliczenie z oceną		
	4	Water resource management (gospodarowanie zasobami wodnymi) [wykład]	zaliczenie z oceną		
	4	Water resource management (gospodarowanie zasobami wodnymi) [zajęcia terenowe]	zaliczenie z oceną		

Basic reading	Neil S. Grigg (2016): Integrated Water Resource Management, Palgrave Macmillan, London
Supplementary reading	

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**45**	**0**
Participation in test / exam	**1**	**0**
Preparation for contact hours	**35**	**0**
Private reading and studying	**15**	**0**
Participation in tutorials	**15**	**0**
Preparation of project / essay / etc.	**2**	**0**
Preparation for test / exam	**12**	**0**
TOTAL workload	**125**	
ECTS credits	**5**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-GiBE-O-I-S-23/24Z**	
Unit: **Blok wykładów do wyboru B [moduł]**	
Course title: **Behavioural ecology (ekologia behawioralna) (KIERUNKOWE)**	Course code: **SPR85AIJ3446_8S**
Name of field of study: **genetyka i biologia eksperymentalna**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **elective**	Language of instruction: **semester: 6 - english language**

Year	Semester	Form of instruction	No. of hours	w tym e-learning	Type of credit	ECTS
3	6	lecture	10	0	pg	1
Total			**10**			**1**

Course / module coordinator	**dr hab. DARIUSZ WYSOCKI**
Course instructor	**dr hab. DARIUSZ WYSOCKI**
Course / module objectives	**Acquainting with the issues of animal ethology. Acquisition of the ability to formulate and solve scientific problems through the proper selection of sources and advanced research methods and their critical evaluation in the light of existing and constantly acquired knowledge in the field of ecology and ethology of animals.**
Prerequisites	**Basic knowledge of biology**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**the student knows the achievements of behavioural ecology**	**K_W01**
	2	**EP2**	**student describes and characterizes analytical methods and comparative methods used in behavioral ecology.**	**K_W07**
skills	**1**	**EP3**	**the student can study literature**	**K_U02**
social competences	**1**	**EP4**	**the student shows openness to new ideas and is ready to change his opinion in the light of available data and arguments**	**K_K03**

CONTENT	Semester	No. of hours	w tym e-learning
Subject title: **Behavioural ecology (ekologia behawioralna)**			
Format of instruction: **lecture**			
1. **Adaptation, direct and ultimate factors.**	6	2	0
2. **Evolution of sexuality and sexual selection.**	6	2	0
3. **Mating systems in humans and animals**	6	6	0

Modes of delivery	**written works**

Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP3,EP4**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	
Grading criteria	**Written work from the content of the lectures.** **When determining the grades, the rules adopted in the Study Regulations of the University of Szczecin, art. 38 and 44.**	
	Grade calculation principles	
	The final grade is equivalent to the grade from the lectures.	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	6	Behavioural ecology (ekologia behawioralna)		Arytmetyczna	
	6	Behavioural ecology (ekologia behawioralna) [wykład]	zaliczenie z oceną		

Basic reading	Krebs J.R., Davies N.B. (red.) (2001): Ekologia Behawioralna., Wydawnictwo Naukowe PWN., Warszawa.
Supplementary reading	Bieżąca literatura dotycząca najnowszych osiągnięć ekologii behawioralnej

STUDENT WORKLOAD

	No. of hours	W tym e-learning
Contact hours	**10**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**0**	**0**
Private reading and studying	**4**	**0**
Participation in tutorials	**4**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**5**	**0**
TOTAL workload	**25**	
ECTS credits	**1**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-BPK-O-II-S-25/26Z**		
Unit: **Blok przedmiotów do wyboru 2**		
Course title: **forensic aerobiology (aerobiologia sądowa)** **(POZOSTAŁE PRZEDMIOTY / MODUŁY)**		Course code: **SPR92AIIJ3446_15S**
Name of field of study: **biologiczne podstawy kryminalistyki**		
Mode and cycle of study: **second degree, full - time**	Profile of study: **general academic**	Specialty:
Course / module status **elective**	Language of instruction: **semester: 2 - english language**	

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
1	2	laboratory	20	0	pg	3
		lecture	10	0	pg	
Total			**30**			**3**

Course / module coordinator	**dr hab. MAŁGORZATA PUC**
Course instructor	**prof. dr hab. AGNIESZKA GRINN-GOFROŃ , dr hab. MAŁGORZATA PUC**
Course / module objectives	**Obtaining knowledge of bioaerosol composition, pollen morphology and phenomena influencing particle dispersion in the atmosphere. Acquainting with the practical significance of pollen and fungi spores in the judiciary (indication and differentiation of the nature of evidence in court proceedings). Acquisition:** **- the ability to recognize pollen grains and microscopic fungi spores,** **- the ability to make microscopic preparations,**
Prerequisites	**Knowledge of basic biology topics at a secondary school level**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**Characterizes processes occurring in the air that influence pollen and spore dispersion in relation to pollination phenology and sporulation**	**K_W01**
	2	**EP2**	**Knows the structure of plant pollen and fungal disputes in the context of their use as evidence in court proceedings**	**K_W05**
	3	**EP3**	**Knows the sampling methodology for pollen and dispersal analyses in accordance with the procedures of microtrack analysis**	**K_W10**
skills	**1**	**EP4**	**Analyses correlations between phenological phenomenons, weather factors and pollen and spore occurence in the air over a given area**	**K_U04**
	2	**EP5**	**Microscopically recognizes selected pollen grains and fungal spores according to their morphological features**	**K_U05**
	3	**EP6**	**Applies methods of palynological analyses**	**K_U01**
	4	**EP7**	**Interprets literature data from a variety of sources (ex. in plant taxonomy)**	**K_U02**
	5	**EP8**	**Prepares conference reports for national and foreign conferences on the aerobiological issues**	**K_U13**
	6	**EP9**	**Presents the results of aeropalinological analyses in Polish or in a foreign language at scientific meetings**	**K_U15**

social competences	1	EP10	**Demonstrates attention to the achievements and traditions of the criminologist profession**	**K_K05**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **forensic aerobiology (aerobiologia sądowa)**			
Format of instruction: **lecture**			
1. **History of forensic palynology and mycological analyzes in forensics. Morphology of pollen grains of taxa useful in forensics.**	2	2	0
2. **Pollen season and pollen calendar - determining the time and place of a crime based on presence of pollen grains on the surface of the tested objects. Meteorological, phenological and biogeographic factors, influencing the dispersion of pollen and spores in the atmosphere. Plant pollen as evidence material**	2	2	0
3. **Anamorphic fungal spores as evidence. Methodology of qualitative and quantitative assessment of pollen on the investigated objects**	2	2	0
4. **Morphological characteristics of selected spores, characteristics of fungal colonies**	2	2	0
5. **Use of aerobiological data in criminal and civil assault cases, burglary, forgery, homicide, rape, smuggling, drug trafficking and terrorism.**	2	2	0
Format of instruction: **laboratory**			
1. **Information on the rules of safe work at a laboratory stand. Microscopic preparation, permanent preparations with pollen and spores, staining, closing slides. Grain structure and recognition of plant pollen and fungal spores on microscopic slides.**	2	4	0
2. **Air sampling by volumetric and gravimetric method. Pollen and spores content analysis in the air. Seasonal dynamics. Structure and recognition of pollen grains and spores of fungi on microscopic slides**	2	4	0
3. **Analysis of exemplary cases (historical lawsuits, recreating conditions of crimes based on pollen material). Characteristics of the indoor environment. Analysis of the content of spores and pollen in the indoor environment. Construction and recognition of plant pollen grains and fungal spores on microscopic slides**	2	4	0
4. **Data analysis, descriptive statistics, correlation, multiple regression. Forecasting the beginning of pollen seasons. Development and analysis of pollen and spore calendars**	2	4	0
5. **Statistical prognostic models: artificial neural networks (ANN); multi-regressive neural tree (MRT).**	2	4	0

Modes of delivery	**- preparation of a project / essay, - microscopy and palynological preparation; - multimedia presentation**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	PRACA PISEMNA/ ESEJ/ RECENZJA	**EP1,EP2,EP3,EP6**
	PREZENTACJA	**EP1,EP10,EP2,EP3, EP7,EP8,EP9**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP10,EP4,EP5,EP7**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**ASSESSMENT for lectures - preparation of a project / essay based on the issues carried out during the lectures; ASSESSMENT FOR laboratories - partial written test, oral test - recognition of fungal spores and plant pollen under the microscope;**
	Grade calculation principles
	To obtain a final grade in a subject, it is necessary to pass EVERY form of classes (laboratories, lectures) with a POSITIVE GRADE. The grade in the subject is calculated: final grade from the exercises and grade from the written test / essay covering the content of the lecture in relation to practical exam in laboratories (sporomorph recognition) 1: 1

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	2	forensic aerobiology (aerobiologia sądowa)		Arytmetyczna	
	2	forensic aerobiology (aerobiologia sądowa) [wykład]	zaliczenie z oceną		

	2	forensic aerobiology (aerobiologia sądowa) [laboratorium]	zaliczenie z oceną		

Basic reading	autorzy artykulów/authors of publications (2024): aktualne publikacje z czasopism naukowych, AiT Labolatories i in. , USA, EU
	autorzy artykułów (2022): International Journal of Criminal Investigation, AiT Labolatories , USA,EU
	Burnett H., L. (2020): Illustrated Genera of Imperfecta Fungi, ISBN: 978-0-89054-192-0, USA
	Dybowa-Jachowicz S., Sadowska A. (red) (2003): Palinologia, PAN, Kraków
	George B. (2019): Illustrated Genera of Rust Fungi, Third Edition, ISBN: 978-0-89054-304-7, USA
	Weryszko-Chmielewska E. (red.) (2007): Aerobiologia, Wyd. Akademii Rolniczej, Lublin
Supplementary reading	Mildenhall, D. C. Wiltshire, P. E. J. Bryant. V. M. (2006): Forensic palynology - Why do it and how it works, For Sci Int. 163, UK

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**30**	**0**
Participation in test / exam	**4**	**0**
Preparation for contact hours	**13**	**0**
Private reading and studying	**10**	**0**
Participation in tutorials	**6**	**0**
Preparation of project / essay / etc.	**6**	**0**
Preparation for test / exam	**6**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-B-O-II-S-25/26Z**	
Unit: **Blok wybieralny III [budowa, funkcja i rozwój organizmów] [moduł]**	
Course title: **Ornithology (ornitologia) (KIERUNKOWE)**	Course code: **SPR23AIIJ3446_54S**
Name of field of study: **biologia**	
Mode and cycle of study: **second degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **elective**	Language of instruction: **semester: 4 - english language polish language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	4	laboratory	15	0	pg	2
		lecture	10	0	pg	
Total			**25**			**2**

Course / module coordinator	**dr hab. DARIUSZ WYSOCKI**
Course instructor	**dr hab. DARIUSZ WYSOCKI**
Course / module objectives	**Acquainting with selected issues concerning the biology of birds. Acquiring the ability to link the morphological features of birds with the ecological niche. Is able to indicate the sources of bird variability and develop awareness of the need to protect biodiversity.**
Prerequisites	**Knowledge of the systematics and anatomy of vertebrates**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**explains complex phenomena and processes related to variability of birds**	**K_W01**
skills	**1**	**EP2**	**is able to integrate the obtained information and implement the latest achievements in the field of biological sciences**	**K_U02**
	2	**EP4**	**is able to integrate the information obtained and implement the latest achievements in the field of biological sciences**	**K_U02**
	3	**EP5**	**properly uses theoretical and empirical foundations to interpret natural phenomena and processes**	**K_U02 K_U04 K_U10**
social competences	**1**	**EP3**	**critically evaluates the possessed knowledge and received content in the field of biological sciences**	**K_K01**
	2	**EP6**	**critically evaluates the knowledge and content received in the field of biological sciences**	**K_K01 K_K03 K_K04**
	3	**EP7**	**recognises the importance of biological knowledge in solving cognitive and practical problems**	**K_K02 K_K06 K_K10**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Ornithology (ornitologia)**			
Format of instruction: **lecture**			
1. **Overview of birds of different habitats**	4	10	0

Format of instruction: **laboratory**			
1. **Foraging optimization theory**	4	2	0
2. **Choice of environment and territory**	4	4	0
3. **Social behaviour**	4	4	0
4. **Population dynamics**	4	5	0

Modes of delivery	**lecture, project**	
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.	
Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP3,EP4,EP5,EP7**
	PREZENTACJA	**EP1,EP2,EP3,EP4,EP5,EP6,EP7**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	
Grading criteria	**Receiving a positive mark on the final test and a positive mark on the prepared presentation**	
	Grade calculation principles	
	Assessment of the presentation and final test 50:50	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	4	Ornithology (ornitologia)		Arytmetyczna	
	4	Ornithology (ornitologia) [wykład]	zaliczenie z oceną		
	4	Ornithology (ornitologia) [laboratorium]	zaliczenie z oceną		

Basic reading	Gill F. (2019): Ornitology, Freeman & Co
Supplementary reading	Fritsch C., Jankowiak Ł., Wysocki D. (2019): Exposure to Pb impairs breeding success and is associated with longer lifespan in urban European blackbirds, Sci Rep
	Halupka L. et al. 2023. (2023): The effect of climate change on offspring production in 201 avian populations: a global meta-analysis., PNAS.
	Jonsson L. (2003): Ptaki Europy i obszaru śródziemnomorskiego, Muza SA.
	J.R.Krebs, N.B.Davies (2021): Wprowadzenie do ekologii behawioralnej, PWN, Warszawa
	Wysocki D., Witkowska M., Walczakiewicz S. (2023): actors affecting fledglings survival in urban population of European blackbirds in Szczecin (NW Poland), Sci Rep

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**25**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**5**	**0**
Private reading and studying	**2**	**0**
Participation in tutorials	**5**	**0**
Preparation of project / essay / etc.	**6**	**0**

Preparation for test / exam	**5**	**0**
TOTAL workload	**50**	
ECTS credits	**2**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-Mik-O-I-S-24/25Z**	
Unit: **Blok przedmiotów do wyboru 1B**	
Course title: **plant disease and damage diagnostics (POZOSTAŁE PRZEDMIOTY / MODUŁY)**	Course code: **US93AIJ2611_21S**
Name of field of study: **mikrobiologia**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **elective**	Language of instruction: **semester: 3 - english language polish language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	laboratory	20	0	pg	3
		lecture	15	0	pg	
Total			**35**			**3**

Course / module coordinator	**dr PAULINA KRÓL**
Course instructor	**dr Anna Kujawska**
Course / module objectives	**The aim of the course is to introduce the student to the issues related to etiology, symptomatology, epidemiology, pathogenesis of plant diseases caused by biotic factors.**
Prerequisites	**Basic knowledge of the problems of Plant Physiology, Biochemistry, Microbiology, Molecular Biology**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**the student knows the basic features of the construction of representatives of various groups of pathogenic organisms, the morphological and anatomical structures they produce, the methods of reproduction and spread in the environment**	**K_W01 K_W02**
	2	**EP2**	**the student is able to define and characterize concepts concerning the most important phytopathological departments; acquiring knowledge about the role and importance of abiotic factors and pathogens in the environment**	**K_W02**
	3	**EP3**	**the student knows and understands issues related to plant damage by various biotic factors**	**K_W02**
	4	**EP4**	**the student knows the principles of classification of these groups of pathogenic organisms and mastered the most important concepts in the field of taxonomy; can recognize disease symptoms in host plants**	**K_W07**

skills	**1**	**EP5**	**the student has the ability to logically reason, associate and compare the most important features of building representatives of various groups of pathogenic organisms functioning in the environment and recognizing the symptoms of the disease**	**K_U03 K_U09 K_U12**
	2	**EP6**	**the student is able to diagnose and identify the causes of plant diseases**	**K_U09**
	3	**EP7**	**the student is able to carry out tests to check the ability of plants to tolerate biotic stress, apply basic statistical methods to describe the degree of plants damage**	**K_U01 K_U03 K_U04 K_U05**
	4	**EP8**	**the student has the ability to learn independently, to acquire literature and to update and expand knowledge**	**K_U08 K_U16**
	5	**EP9**	**the student is able to cooperate in a team, has the ability to solve problems together, carefully performs the assigned tasks**	**K_U17**
social competences	**1**	**EP10**	**the student follows the rules of health and safety, takes care of the workplace, the apparatus used and the materials entrusted**	**K_K07**
	2	**EP11**	**the student is open to new knowledge, aware of the possibilities of its practical application**	**K_K02 K_K05**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **plant disease and damage diagnostics**			
Format of instruction: **lecture**			
1. **Plant diseases and methods of their identification (traditional and molecular)**	3	4	0
2. **Identification of infections plant diseases caused by microorganisms under natural conditions**	3	6	0
3. **Isolation of bacteria and fungi from diseased plants, their culture**	3	3	0
4. **Control methods of fungal, bacterial and viral diseases**	3	2	0
Format of instruction: **laboratory**			
1. **Methods of isolation of pathogenic organisms**	3	2	0
2. **Basic features of the structure of pathogenic organisms - identification**	3	3	0
3. **Assessment of the degree of infection by pathogenic fungi - isolation methodology**	3	3	0
4. **Assessment of the degree of infection by pathogenic fungi - identification**	3	3	0
5. **Isolation, culture and identification of fungal pathogens causing plant diseases in the form of spots and necrosis**	3	3	0
6. **Isolation, culture and identification of fungal pathogens causing plant diseases in the form of wilting**	3	3	0
7. **Macroscopic and microscopic identification of plant disease symptoms**	3	3	0

Modes of delivery	**carry out of experiments, work in groups, Multimedia presentation**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	SPRAWDZIAN	**EP1,EP2,EP3,EP4**
	PRACA PISEMNA/ ESEJ/ RECENZJA	**EP5,EP6,EP7,EP8**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP10,EP11,EP9**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**Lectures:** **written exam to test knowledge gained during lectures (longer say writing)** **Classes:** **evaluation based on partial grades received during the semestr for, test, report and the student's activity in class**
	Grade calculation principles
	Final grade is the arithemtic average of the evaluation of lectures and evaluation of classes calculated in the ratio of 1:1

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	plant disease and damage diagnostics		Arytmetyczna	
	3	plant disease and damage diagnostics [wykład]	zaliczenie z oceną		
	3	plant disease and damage diagnostics [laboratorium]	zaliczenie z oceną		

Basic reading	Agrios G.N., (2024): Plant Pathology, Academic Press, San Diego California
	JOHN A. LUCAS (2020): Plant Pathology and Plant Pathogens, 4th Edition, Wiley-Blackwell
	Tronsmo A.M. i wsp. (2020): Plant Pathology and Plant Diseases, CABI, USA
Supplementary reading	Nicklin J. i wsp. (2021): Mikrobiologia - krótkie wykłady, Wydawnictwo Naukowe PWN, Warszawa

STUDENT WORKLOAD

	No. of hours	
		including e-learning
Contact hours	**35**	**0**
Participation in test / exam	**4**	**0**
Preparation for contact hours	**7**	**0**
Private reading and studying	**9**	**0**
Participation in tutorials	**10**	**0**
Preparation of project / essay / etc.	**4**	**0**
Preparation for test / exam	**6**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-Biotech-O-I-S-23/24Z**	
Unit: **Moduł V A [moduł]**	
Course title: **self-purification of water (KIERUNKOWE)**	Course code: **US34AIJ2457_56S**
Name of field of study: **biotechnologia**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status **elective**	Language of instruction: **semester: 6 - english language**

Year	Semester	Form of instruction	No. of hours	w tym e-learning	Type of credit	ECTS
3	6	laboratory	15	0	pg	3
		lecture	15	0	pg	
Total			**30**			**3**

Course / module coordinator	**dr hab. inż. AGNIESZKA SZLAUER-ŁUKASZEWSKA**
Course instructor	**dr hab. inż. AGNIESZKA SZLAUER-ŁUKASZEWSKA**
Course / module objectives	**Understanding the mechanisms of contamination of aquatic ecosystems, the influence of elements of water biocenosis on the status of the aquatic environment, knowledge of hydrochemical and hydrological processes which are important for buffering the pollution and improve the chemical and physical properties of water. Knowledge of methods to assess the degree of contamination and susceptibility for degradation of water bodies with understanding the social aspects of the practical application of this knowledge. Ability to properly identify taxa that are indicators of pollution.**
Prerequisites	**general and organic chemistry, physics, biochemistry, microbiology**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	Student recognizes the risks associated with pollution of the water	K_W01 K_W02 K_W06 K_W07
	2	EP2	Student knows the methods to assess the degree of contamination and susceptibility to degradation of surface water	K_W01 K_W02 K_W03
	3	EP3	Student describes the basic mechanisms of self-purification process	K_W01 K_W03
skills	1	EP4	Student evaluates the degree of pollution of surface waters and their susceptibility to degradation	K_U01 K_U02 K_U03
	2	EP5	Student analyzes empirically obtained data of physical and chemical parameters of water as a result of various biological factors, and draws conclusions based on them	K_U01 K_U02 K_U04
	3	EP6	Student is able to classify aquatics organisms to specific ecological formation and identify selected indicator species.	K_U01 K_U02 K_U03
social competences	1	EP8	The student shows an attitude of readiness to the assigned task.	K_K05
	2	EP9	Student understands the social aspects of the practical application of knowledge and skills.	K_K01 K_K02

CONTENT	Semester	No. of hours	w tym e-learning
Subject title: **self-purification of water**			
Format of instruction: **lecture**			
1. **Mechanisms of self-purification**	6	2	0
2. **Water as a living environment**	6	1	0
3. **Surface water pollution**	6	4	0
4. **Saprobic zones**	6	2	0
5. **The importance of interactions between organisms in the self-purification process**	6	1	0
6. **Waterbodies susceptibility to degradation**	6	1	0
7. **Bioindication**	6	1	0
8. **Protection, monitoring, reservoir reclamation**	6	3	0
Format of instruction: **laboratory**			
1. **Characterization of surface water contamination and related groups of organisms.**	6	4	0
2. **Bioindication of the degree of pollution based on existing organisms**	6	2	0
3. **Laboratory experiments using various ecological formations for water treatment**	6	6	0
4. **Representatives of food guilds, their role in the processes of self-purification of water and the circulation of nutrients**	6	3	0

Modes of delivery	**Multimedia presentation based on the author's lecture scenario, Carry out a biological experiment in in the laboratory, Practical exercises in the biological laboratory, microscopic observations, execution drawings, Oral discussion of the scope of the conducted exercises / presentation with a discussion**	
Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP3,EP4,EP5,EP6,EP9**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP6,EP8**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	
Grading criteria	**Presence and activity on exercises.** **Performing practical tasks entrusted during the exercises** **Passing the colloquium with the content discussed during the lecture**	
	Grade calculation principles	
	Establishing a final grade based on partial marks received during the semester for specific student activities and work. **The grade is calculated on the basis of the final grade of the exercises and lectures in the ratio 1: 1**	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	6	self-purification of water		Arytmetyczna	
	6	self-purification of water [wykład]	zaliczenie z oceną		
	6	self-purification of water [laboratorium]	zaliczenie z oceną		

Basic reading	Chełmicki W. (2002): Woda. Zasoby, degradacja, ochrona, PWN, Warszawa
	Turoboyski L. (1979): Hydrobiologia techniczna, PWN, Warszawa
Supplementary reading	Allan J. D. (1998): Ekologia wód płynących, PWN, Warszawa
	Dojlido J. R. (1995): Chemia wód powierzchniowych, Wyd. Ekonomia i Środowisko, Białystok
	Kajak Z. (1998): Hydrobiologia i limnologia. Ekosystemy wód śródlądowych, PWN, Warszawa
	Lampert W. Sommer U. (1996): Ekologia wód śródlądowych, PWN, Warszawa

STUDENT WORKLOAD		
	No. of hours	
		W tym e-learning
Contact hours	**30**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**5**	**0**
Private reading and studying	**10**	**0**
Participation in tutorials	**6**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**22**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

<table>
<tr><td colspan="4">*Subject*: Animal histology</td></tr>
<tr><td colspan="4">*Field of study*: Genetics and Experimental Biology</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>lecture</td><td>10</td><td rowspan="2">3</td><td rowspan="2">English</td></tr>
<tr><td>practical classes</td><td>20</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">dr hab. K. Dziewulska, prof. US</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">Provide students with knowledge of human tissues, organs and systems construction</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">Knowledge of biology from secondary school</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">*Program content of lectures*
1. The structure, distribution and function of the epithelial, connective, blood, muscle, nerve tissues.
2. Histology and function of the selected organs and systems.
Program content of practical classes
1. Histological technique
2. Microscopic observation and structure analysis of epithelial, connective, blood, muscle, nerve tissues
3. Histology of selected organs – microscopic observation</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">- multimedia presentation
- individual observation under a microscope</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">- completion of lectures: final written test - knowledge from lectures and recommended literature
- completion of practical classes: passing of microscopic observation and drawing in notebook and written test
- Final evaluation: arithmetic mean of grades (test results for passing lectures and practical classes)</td></tr>
<tr><td>*Literature*</td><td colspan="3">Mescher A.L.- Junqueira's Basic Histology: text and atlas. McGraw Hill 17 th edition, 2023.
Lowe J.S., Anderson P.G., Anderson S. (Stevens A., Lowe J.) – Stevens & Lowe's Human histology 6th edition. Mosby Ltd, 2024
Gartner L. Textbook of histology. 5 th edition, Elsevier 2020</td></tr>
</table>

<table>
<tr><td colspan="4">*Subject*: Anthropogenic transformations of plant cover</td></tr>
<tr><td colspan="4">*Field of study*: Environmental protection and engineering</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>lectures</td><td>15</td><td rowspan="2">4</td><td rowspan="2">English</td></tr>
<tr><td>laboratories</td><td>15</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">dr hab. Monika Myśliwy, prof. US</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">Acquainting students with the effects of anthropopressure at various levels of the biosphere organization. Acquiring the ability to recognize selected species of synanthropic plants and to assess anthropogenic changes in the flora. Shaping readiness to inspire actions for the protection of biodiversity.</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">Basics of plant systematics and ecology</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">Lectures:
1. Synanthropization with regard to landscape, vegetation, flora, population and species; origin of plant species, indicators of anthropogenic changes in flora.
2. The impact of economic use of forests on vegetation, stages of neophytism, degeneration of phytocoenoses. Differentiators of pro-ecological forestry; anti-synanthropization decalogue.
3. Human impact on plant evolution, examples of taxa hybridization due to the abolition of geographic and ecological barriers, selection pressure, etc.
4. Characteristics of selected anthropogenic habitats; review of synanthropic plants in Poland.
Laboratories:
1. Analysis of synanthropic flora: geographical and historical division of flora, indicators of anthropogenic changes in flora - practical exercises.
2. Overview of synanthropic species in the flora of Poland: characteristics, identification on the basis of diagnostic features; individual work with plant material, macro- and microscopic observations.
3. Analysis of the habitat spectrum and life forms of selected species of archaeophytes and neophytes - practical exercises.
4. Centers of origin of cultivated plants, examples of anthropogenic changes in ranges - student projects.</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">Lectures with multimedia presentations. Individual work with herbarium specimens and microscopes. Individual project.</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">Written exam, positive evaluation of the completed project</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Myśliwy M. 2008. Vascular plants of forest dividing-lines, analyzed in respect of forest complex synanthropisation. Biodiversity Research and Conservation 9-10: 63-72.
2. Myśliwy M. 2014. Habitat preferences of some neophytes, with a reference to habitat disturbances. Polish Journal of Ecology 63: 509-524.
3. Sushma Naithani 2021. History and Science of Cultivated Plants. https://open.oregonstate.education/cultivatedplants/chapter/cropplants/
4. Reyes O. 2022. Ecological forestry in Europe. How sound forest management can help to preserve and restore nature. Final Report. The Greens/EFA in the European</td></tr>
</table>

	Parliament. https://www.greens-efa.eu/files/assets/docs/20221007_thegreens_ecological_forestry_in_europe_web.pdf

<table>
<tr><td colspan="4">*Subject*: Basic histology for animal cell culture</td></tr>
<tr><td colspan="4">*Field of study*: Biotechnology</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>lecture</td><td>15</td><td rowspan="2">4</td><td rowspan="2">English</td></tr>
<tr><td>practical classes</td><td>15</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">dr hab. K. Dziewulska, prof. US</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">Provide students with knowledge of human tissues and principles of organ and system structure</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">Knowledge of biology from secondary school</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">*Program content of lectures*
1. Histological technique (2h)
2. Introduction to cell culture. The structure, distribution and function of the epithelial, connective, blood, muscle, nerve tissues and susceptibility of cells to in vitro culture (10h).
3. Histology and function of the digestive tract (3h).
Program content of practical classes
1. Histological technique (2h)
2. Microscopic observation of epithelial, connective, blood, muscle, nerve tissues on histological slides (10h)
3. Histology of selected organs – digestive tract microscopic observation (3h)</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">- multimedia presentation
- individual observation under a microscope</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">- completion of lectures: final written test - knowledge from lectures and recommended literature
- completion of practical classes: passing of microscopic observation and drawing in notebook and written test
- Final evaluation: arithmetic mean of grades (test results for passing lectures and practical classes)</td></tr>
<tr><td>*Literature*</td><td colspan="3">Mescher A.L.- Junqueira's Basic Histology: text and atlas. McGraw Hill 17 th edition, 2023.
Lowe J.S., Anderson P.G., Anderson S. (Stevens A., Lowe J.) – Stevens & Lowe's Human histology 6th edition. Mosby Ltd, 2024
Gartner L. Textbook of histology. 5 th edition, Elsevier 2020</td></tr>
</table>

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-GiBE-O-I-S-24/25Z**

Unit:
Przedmioty do wyboru I [moduł]

Course title: **Basics of plant taxonomy (KIERUNKOWE)**	Course code: **SPR85AIJ3446_31S**

Name of field of study:
genetyka i biologia eksperymentalna

Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic**	Specialty:

Course / module status **elective**	Language of instruction: **semester: 3 - English language**

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	laboratory	20	0	pg	3
		lecture	10	0	pg	
Total			**30**			**3**

Course / module coordinator	**dr hab. HELENA WIĘCŁAW**
Course instructor	**dr hab. HELENA WIĘCŁAW , dr hab. BEATA BOSIACKA**
Course / module objectives	**Introduction to the taxonomic concepts, research methods and plant diversity** **Gaining the ability to recognize plant taxa using specialized keys**
Prerequisites	**Basic knowledge of biology at the high school level**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	**1**	**EP1**	**The student knows and understands the definitions and is able to characterize biological, chemical and physical processes**	**K_W01 K_W05**
	2	**EP2**	**The student knows the research methods used in plant taxonomy and knows how to use them**	**K_W02 K_W07**
skills	**1**	**EP3**	**The student is able to find in the literature and correctly apply information on plant taxonomy**	**K_U02 K_U07**
	2	**EP4**	**The student is able to apply statistical methods used in plant taxonomy; can identify plant species using a special key**	**K_U05**
social competences	**1**	**EP5**	**The student is aware of his knowledge and the need to deepen it**	**K_K01 K_K03**
	2	**EP6**	**The student is creative and uses his knowledge in the implementation of the task entrusted to him**	**K_K04**

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Basics of plant taxonomy**			
Format of instruction: **lecture**			
1. **Introduction to plant taxonomy: purpose, basic concepts and sources of taxonomic information.**	3	2	0
2. **Principles and methods used in classical plant taxonomy. Nomenclature, taxonomic ranks, species concept, phenetic taxonomy. A modern, updated classification system for angiosperms - the APG system.**	3	4	0
3. **Phylogenetic taxonomy and methods used in phylogenetic analysis. Basic differences between Linean and phylogenetic taxonomy.**	3	4	0

Format of instruction: **laboratory**			
1. Algae as a polyphyletic taxon. Overview of selected taxonomic groups.	3	2	0
2. Taxonomic diversity and characteristics of bryophytes. Identification of plant materials based on micro- and macroscopic features	3	2	0
3. Taxonomic review of clubmoss, horsetails and ferns. Identification of plant materials based on micro- and macroscopic features.	3	2	0
4. Classification, taxonomic diversity and characteristics of seed plants. Identification of plant materials based on micro- and macroscopic features.	3	14	0

Modes of delivery	**individual and group work with plant material (microscope, binocular, magnifier) and keys for plant identification, observation, multimedia presentation**
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.

Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2**
	SPRAWDZIAN	**EP1,EP2,EP3**
	ZAJĘCIA PRAKTYCZNE (WERYFIKACJA POPRZEZ OBSERWACJĘ)	**EP3,EP4,EP5,EP6**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	

Grading criteria	**Lectures are passed on the basis of a written test, during which knowledge from lectures and recommended literature is checked.** **Laboratoryclasses are passed on the basis of attendance, active work in class and partial tests.**
	Grade calculation principles
	The final grade of the course is calculated as the arithmetic average of the grades from lectures and laboratory classes.

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	Basics of plant taxonomy		Aritmetic	
	3	Basics of plant taxonomy [lecture]	pg		
	3	Basics of plant taxonomy [practicals]	pg		

Basic reading	Ackles E. (2020): Botany: Plant Identification and Classification. , CALLISTO REFERENCE
	Rutkowski L. (2020): Klucz do oznaczania roślin naczyniowych Polski niżowej, Wydawnictwo Naukowe PWN, Warszawa
	Simpson M. G. (2019): Plant Systematics, Academic Press, Elsevier.
	Stace C. A. (1993): Taksonomia roślin i biosystematyka, PWN, Warszawa
	Szweykowska A., Szweykowski J. (2022): Botanika Tom II, Wydawnictwo Naukowe PWN, Warszawa
Supplementary reading	Mitka J. (2004): Taksonomia lineuszowska w dobie biologii molekularnej, Fragm. Florist. et Geobot. Polonica, Kraków
	Stevens P. F. (2017): Angiosperm Phylogeny Website. Version 14, http://www.mobot.org/MOBOT/research/APweb/ - aktualizowana
	Stuessy T. F. (2009): Plant Taxonomy. The systematic evaluation of comparative data, Columbia University Press, New York

STUDENT WORKLOAD

	No. of hours	including e-learning
Contact hours	**30**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**10**	**0**
Private reading and studying	**10**	**0**

Participation in tutorials	**8**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**15**	**0**
TOTAL workload	**75**	
ECTS credits	**3**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-Mik-O-II-S-25/26Z**		
Course title: **Bioinformatics of microbiomes from various environments (KIERUNKOWE)**		Course code: **SPR93AIIJ3450_12S**
Name of field of study: **mikrobiologia**		
Mode and cycle of study: **second degree, full - time**	Profile of study: **general academic**	Specialty:
Course / module status **obligatory**	Language of instruction: **semester: 3 - polish language**	

Year	Semester	Form of instruction	No. of hours	including e-learning	Type of credit	ECTS
2	3	practicals	25	0	pg	2
Total			**25**			**2**

Course / module coordinator	**dr DANUTA CEMBROWSKA-LECH**
Course instructor	**dr DANUTA CEMBROWSKA-LECH**
Course / module objectives	**The aim of the course is for students to learn bioinformatics analysis of data from sequencing samples of various environments, as well as to learn the population composition and biological potential of organisms present in the tested material. Participants of the course have the opportunity to analyze data from 16S rRNA sequencing and metagenome sequencing using shotgun methods.**
Prerequisites	**Basic knowledge of bioinformatics, molecular biology and microbiology.**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	the student knows the basic types of data and their structures	K_W07
	2	EP2	the student knows the variety of types of biological data and the formats in which they are saved	K_W07
	3	EP3	the student knows selected issues of data analysis in metagenomics	K_W01 K_W05 K_W07
skills	1	EP4	the student is able to use regular expressions to edit and process text data	K_U05 K_U07
	2	EP5	the student is able to perform advanced numerical analysis of biological data and interpret the results	K_U03 K_U04 K_U05 K_U06
	3	EP6	the student is able to perform complex data analysis and skillfully select appropriate algorithms for this purpose	K_U03 K_U05 K_U07
social competences	1	EP7	the student is ready to work independently and in a team to complete the given task and present the obtained solutions	K_K02 K_K05
	2	EP8	the student is ready to independently expand and deepen his knowledge in the field of advanced biological data analysis techniques	K_K01 K_K02 K_K03 K_K04

CONTENT	Semester	No. of hours	including e-learning
Subject title: **Bioinformatics of microbiomes from various environments**			
Format of instruction: **practicals**			

1. **Introduction to bioinformatics in microbiology**	3	1	0
2. **DNA sequence assembly and annotation of genes**	3	4	0
3. **Introduction to phylogenetic analysis of molecular sequence data**	3	4	0
4. **Metagenomics data analysis: 16S rRNA amplicon sequencing**	3	8	0
5. **Data analysis in metagenomics: shotgun DNA sequencing**	3	8	0

Modes of delivery	**Individual work, multimedia presentation, solving tasks, working on computers.**	
	The course teacher shall specify how artificial intelligence should be used as part of implementation of the course according to University of Szczecin best practices and standards. The course teacher shall inform students in their first class about the scope and possibilities of using AI and shall present a catalogue of tools and applications adjusted to relevant learning outcomes and teaching needs and possibilities within a given course.	
Assessment methods		No. of learning outcome from the syllabus
	PROJEKT	**EP1,EP2,EP3,EP4,EP5,EP6,EP7,EP8**
	Metody i formy weryfikacji efektów uczenia się mogą zostać zmienione dla studentów ze szczególnymi potrzebami na warunkach i zasadach określonych w Regulaminie Studiów Uniwersytetu Szczecińskiego.	
Grading criteria	**Active participation in laboratories, presentation of solutions to assigned bioinformatics analysis tasks, project including tasks to be solved independently**	
	Grade calculation principles	
	The course grade is determined based on the final grade from laboratory classes	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	Bioinformatics of microbiomes from various environments		weight	
	3	Bioinformatics of microbiomes from various environments [practicals]	pg		1,00

Basic reading	Błaszczak A., Frelik G. (2020): Wprowadzenie do bioinformatyki, PWN, Warszawa
Supplementary reading	Basant K. Tiwary (2022): Bioinformatics and Computational Biology. A Primer for Biologists, Springer Singapore, Singapore
	Ramsden J. (2023): Bioinformatics, Springer Cham, Switzerland

STUDENT WORKLOAD

	No. of hours	including e-learning
Contact hours	**25**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**4**	**0**
Private reading and studying	**3**	**0**
Participation in tutorials	**6**	**0**
Preparation of project / essay / etc.	**8**	**0**
Preparation for test / exam	**2**	**0**
TOTAL workload	**50**	
ECTS credits	**2**	

	Subject: **Biological methods of water assessment**					Subject code: SPR208AIJ3450_31S	
	Nazwa jednostki prowadzącej przedmiot / moduł: **Institute of Biology**						
	Nazwa kierunku:						
	Forma studiów: **-**		Profil kształcenia: -			Specj-alność:	
	Year / semester: **2/3**		Status przedmiotu /modułu: **-**			Język przedmiotu / modułu: **English**	
	Forma zajęć	lecture	Practical classes	Laboratory	Discussion classes	seminar	Field classes
	Wymiar zajęć	**15**	**15**				

Koordynator przedmiotu / modułu	dr Tomasz Krepski
Prowadzący zajęcia	dr Tomasz Krepski
Cel przedmiotu / modułu	The aim of the object is to provide for students an information about the freshwater biological and ecological assessment.
Wymagania wstępne	Basic knowledge of biology, ecology, physics, chemistry.

LEARNING OUTCOMES			
Knowledge	01 Student characterizes the methods of water basin assessment 02 Student knows the biological and ecological methods of freshwater assessment		
Skills	03 Student choose the methods of water basin assessment 04 Student compares the characteristics of different water freshwater types		
Social competences	05 Student works independently 06 Student cares about water basins		

CONTENT	
Bioindicators used in the freshwater assessment	
Ecological assessment of the river and lake	
Assessment of freshwaters in European Union	

Modes of delivery	• Multimedia presentation • Working in groups	
Assessment methods		
	• Grading • Test	
Final grade calculation method	Class attendance, written tests	
ECTS credits	**3**	

<table>
<tr><td colspan="4">*Subject*: hematological diagnostics</td></tr>
<tr><td colspan="4">*Field of study*: biology</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>Lectures</td><td>15</td><td rowspan="2">3</td><td rowspan="2">English</td></tr>
<tr><td>Laboratories</td><td>30</td></tr>
<tr><td>*Year/Semester*</td><td colspan="3">2/4</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">Dr hab. Wioleta Dudzińska, dr n. med. Katarzyna Sielatycka</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">The aim of teaching the subject is to familiarize students with the basic mechanisms of physiology and pathology of hematopoiesis in connection with diagnostic tests in the field of: hematology, cytomorphology and coagulology. In addition, mastering the ability to independently perform tests, interpret the results and assess their credibility.</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">Basics knowledge of blood physiology.</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Peripheral blood morphology. Red blood cell system, white blood cell system and platelets
2. Diagnosis of hematological anemia.
3. Diagnostics of iron deficiency anemia.
4.Hemostasis. Basic research in the field of coagulation.
5. Methods of cytochemical and cytoenzymatic tests used in hematological diagnostics.</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• Presentation
• Groupwork
• Practical classes</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">Written exam</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Sophie Chargé, PhD, and Kendra Hodgkinson, PhD ; Blood: the basics; 2017
2. Mohamed Salama & Teruya-Feldstein Julie & Kremyanskaya Marina; Atlas of Diagnostic Hematology, 1st Edition; 2020</td></tr>
</table>

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-Mik-O-II-S-24/25Z**

Unit:
Blok przedmiotów do wyboru 3 [moduł]

Course title:	Course code:
Immunological techniques based on molecular methods in microbial diagnostics (zastosowanie technik immunologicznych w diagnostyce mikrobiologicznej z wykorzystaniem metod molekularnych) **(POZOSTAŁE PRZEDMIOTY / MODUŁY)**	**SPR93AIIJ3450_47S**

Name of field of study:
microbiology (mikrobiologia)

Mode and cycle of study:	Profile of study:	Specialty:
second degree, full - time	**general academic**	

Course / module status	Language of instruction:
elective	**semester: 3 - English language**

Year	Semester	Form of instruction	No. of hours		Type of credit	ECTS
				w tym e-learning		
2	3	laboratory	15	0	pg	2
		lecture	15	0	pg	
Total			**30**			**2**

Course / module coordinator	**dr hab. PAULINA NIEDŹWIEDZKA-RYSTWEJ**
Course instructor	**dr hab. PAULINA NIEDŹWIEDZKA-RYSTWEJ**
Course / module objectives	**Familiarization with immunological techniques that use the methods of molecular biology, used in microbiological diagnostics. Practicing the ability to apply selected methods of molecular biology for proper microbiological diagnostics. Working in a group, team, independent, building awareness of responsibility for the performed experiments.**
Prerequisites	**Basics of immunology**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	**Student characterizes and describes the role and importance of antibodies.**	**K_W02**
	2	EP2	**The student lists selected techniques of immunological methods based on biology molecular (e.g. ELISA, Blotting, flow cytometry).**	**K_W06**
skills	1	EP3	**The student selects the immunological method for the assumed research purpose and interprets the legitimacy of such selection.**	**K_U01**
	2	EP4	**The student interprets and is able to indicate the use of immunological techniques with the use of molecular biology.**	**K_U02**
social competences	1	EP5	**The student follows the safety rules.**	**K_K09**
	2	EP6	**The student perceives and is aware of the legitimacy of using molecular biology in immunology.**	**K_K02**
	3	EP7	**The student is aware of the imperfection of his knowledge and tries to verify and deepen it, using all methods of personal development.**	**K_K01**

CONTENT	Semester	No. of hours	w tym e-learning
Subject title: **Immunological techniques based on molecular methods in microbial diagnostics**			
Format of instruction: **lecture**			
1. **Fundamentals of classical immunology - characteristics of antibodies, their application and production.**	3	4	0

2. **Selected tests used in diagnostics - ELISA, Blotting.**	3	4	0
3. **The use of antibodies labeled with fluorochromes: flow cytometry, fluorescence microscopy.**	3	4	0
4. **PCR and its variants in microbiological diagnostics.**	3	3	0
Format of instruction: **laboratory**			
1. **Detection of antigens using ELISA and Blotting technique.**	3	5	0
2. **Flow cytometry using labeled cells.**	3	5	0
3. **Practical application of selected techniques of molecular biology in microbiological diagnostics.**	3	5	0

Modes of delivery	**multimedia presentation; work in groups; practical classes**	
Assessment methods		No. of learning outcome from the syllabus
	KOLOKWIUM	**EP1,EP2,EP3,EP4**
	PRACTICAL CLASSES	**EP3,EP4,EP5,EP6,EP7**
Grading criteria	**Pass with a grade (a longer written statement based on the knowledge acquired during the lectures and contained in the basic literature). Passing the practical part on the basis of a written colloquium with questions mainly related to the practical performance of tasks.**	
	Grade calculation principles	
	The final grade is calculated on the basis of the grade for the exercises and the grade for passing the lecture content in a 1:1 ratio.	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	3	**Immunological techniques based on molecular methods in microbial diagnostics**		aritmetic	
	3	Immunological techniques based on molecular methods in microbial diagnostics [laboratory]	pg		
	3	Immunological techniques based on molecular methods in microbial diagnostics [lecture]	pg		

Basic reading	Bal, J. (2023): Genetyka medyczna i molekularna, Wydawnictwo Naukowe PWN
	Bulanda, M.; Pietrzyk, A.; Wróblewska, M. (2023): Mikrobiologia lekarska Tom 1, PZWL Wydawnictwo Lekarskie
	Bulanda, M.; Pietrzyk, A.; Wróblewska, M. (2023): Mikrobiologia lekarska Tom 2, PZWL Wydawnictwo Lekarskie
	Katnik-Prastowska, I. (2009): Immunochemia w biologii medycznej: metody laboratoryjne, Wydawnictwo Naukowe PWN, Warszawa
	Lewandowska Ronnegren, A. (2023): Techniki laboratoryjne w biologii molekularnej, Medpharm, Wrocław
	Naskalski, A.; Dembinska-Kiec, J.W.; Solnica, B. (2022): Diagnostyka laboratoryjna z elementami biochemii klinicznej, Edra Urban & Partner
	Solnica, B. (2019): Diagnostyka laboratoryjna, PZWL Wydawnictwo Lekarskie
	Szewczyk, E.M. (2019): Diagnostyka bakteriologiczna, Wydawnictwo Naukowe PWN, Warszawa
Supplementary reading	Czasopisma: Postepy Mikrobiologii, Alergia Astma Immunologia, Biotechnologia, Postepy Higieny i Medycyny Doswiadczalnej, Postepy Biologii Komórki, Central European Journal of Immunology, Postepy Biochemii, International Journal of Molecular Sciences, Vaccines, Microorganisms, Pathogens, Cells, Antibiotics, Viruses, Nature Immunology, International Immunology :
	Deptuła, W.; Tokarz-Deptuła, B.; Pisarski, R. (2014): Immunologia - fakty znane i nieznane., Wydawnictwo PWSZ, Legnica, Lenica

STUDENT WORKLOAD

	No. of hours	W tym e-learning
Contact hours	**30**	**0**
Participation in test / exam	**2**	**0**
Preparation for contact hours	**2**	**0**
Private reading and studying	**8**	**0**
Participation in tutorials	**0**	**0**
Preparation for test / exam	**8**	**0**
TOTAL workload	**50**	
ECTS credits	**2**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-Mik-O-I-S-24/25Z**	
Course title: **Immunology (immunologia) (KIERUNKOWE)**	Course code: **US93AUJ2614_29S**
Name of field of study: **microbiology**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status: **obligatory**	Language of instruction: **semester: 4 - English language**

Year	Semester	Form of instruction	No. of hours		Type of credit	ECTS
				e-learning		
2	4	laboratory	37	0	pg	5
		lecture	30	0	e	
Total			**67**			**5**

Course / module coordinator	**dr hab. PAULINA NIEDŹWIEDZKA-RYSTWEJ**
Course instructor	**dr hab. PAULINA NIEDŹWIEDZKA-RYSTWEJ**
Course / module objectives	**Familiarization with the defense mechanisms of a macroorganism after contact with bacteria, viruses or fungi. Explanation of immunity reactions, including allergic reactions as well as those leading to immune diseases**
Prerequisites	**Knowledge of the structure and pathogenic action of microorganisms (after a course in Bacteriology and in the subject Virology**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	The student characterizes the structure of the system immune system in mammals, including human	K_W01 K_W02 K_W05
	2	EP2	The student explains the mechanism of immune system cells.	K_W0 1 K_W05
skills	1	EP3	The student makes observations and characterizes the cells of the system immunity under the microscope	K_U02 K_U04
	2	EP4	The student analyzes the basics immune mechanisms and selects methods to detect the chosen immunity mechanism	K_U03 K_U04 K_U05
	3	EP5	The student interprets the results sample immunoassays	K_U04 K_U06 K_U07 K_U09
	4	EP6	The student analyzes the literature in the field issues discussed in the course	K_U06 K_U08 K_U11 K_U16
	5	EP11	The student is able to work independently and in the group	K_U17
social competences	1	EP8	The student is critical in assessing his own and others' work	K_K01 K_K07
	2	EP10	The student complies with the arrangements	K_K01 K_K05
	3	EP12	The student is ready to comply with the rules of professional ethics and to demand it from others	K K08

CONTENT	Semester	No. of hours	
			w tym e-learning
Subject title: **immunology**			
Format of instruction: **lecture**			
1. Structure and function of organs and cells of the immune system (UO). The microbiome and the UO.	4	10	0
2. Mechanisms of specific and non-specific immunity (innate and acquired immunity)	4	10	0
3. Antigen pathway in UO and allergic reactions. Autoimmunity and immune diseases	4	10	0
Format of instruction: **laboratory**			
1 Blood cells as cells of the immune system in a microscopic image	4	7	0
2 Determination of specific and non-specific (innate and acquired) immunity by selected methods.	4	10	0
3. Serological reactions in immunological diagnosis. Monoclonal antibodies	4	10	0
4 Molecular biology tests in immunology	4	10	0

Modes of delivery	**Laboratories - practical classes, Lecture - multimedia presentation**	
Assessment methods		No. of learning outcome from the syllabus
	WRITTEN EXAM	**EP1,EP2**
	KOLOKWIUM	**EP1,EP2**
	TEST	**EP1,EP2,EP5,EP8**
	PRACTICAL CLASSES	**EP10,EP11,EP12,EP3,EP4,EP5,EP6,EP8**
Grading criteria	**Written exam (longer written statement) covering knowledge from lectures. Determining the final grade on the basis of partial grades received during the semester for specific activities and student work during classes**	
	Grade calculation principles	
	The final grade is calculated on the basis of the grade from the exam and the exercises in a ratio of 2:1.	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	4	immunologia		Ważona	
	4	immunologia [wykład]	egzamin		0,67
	4	immunologia [laboratorium]	zaliczenie z oceną		0,33

Basic reading	Abbas A.K., Lichtman A.H., Pillai S. (2021): Immunologia. Funkcje i zaburzenia układu immunologicznego, Urban & Partner, Wrocław
	Bryniarski K., Siedlar M. (2023): Immunologia, Edra Urban & Partner, Wrocław
	Deptuła W., Tokarz-Deptuła B., Pisarski R. (2014): Immunologia - fakty znane i nieznane, , Wyd. PWSZ. , , D Legnica
	Fanger M.W. , Lydyard P. M., Whelan A. (2023): Krótkie wykłady Immunologia, PWN, Warszawa
	Gołab J., Jakóbisiak M., Lasek W., Stokłosa T. (2023): Immunologia, Wydawnictwo naukowe PWN, , Warszawa
	Tizard I. R. (2017): Veterinary Immunology, Elsevier , St. Louis USA
Supplementary reading	(2023): Czasopisma: Alergia, Astma, Immunologia, Kosmos, Postepy Biochemii, Postepy Biologii Komórki, Postepy Higieny i Medycyny Doswiadczalnej, Advancements of Microbiology - Postepy Mikrobiologii, Wszechswiat

STUDENT WORKLOAD

	No. of hours	
		e-learning
Contact hours	**67**	**0**
Participation in test / exam	**4**	**0**

Preparation for contact hours	**12**	**0**
Private reading and studying	**15**	**0**
Participation in tutorials	**4**	**0**
Preparation of project / essay / etc.	**0**	**0**
Preparation for test / exam	**23**	**0**
TOTAL workload	**125**	
ECTS credits	**5**	

COURSE SYLLABUS AND SPECIFICATION

Curriculum title: **USSPR-Biotech-O-I-S-23/24Z**	
Course title: **In vitro culture of plant (roślinne kultury in vitro) (KIERUNKOWE)**	Course code: **US34AIJ2611_29S**
Name of field of study: **biotechnology (biotechnologia)**	
Mode and cycle of study: **first-degree, full - time**	Profile of study: **general academic** / Specialty:
Course / module status: **obligatory**	Language of instruction: **semester: 5 - English language**

Year	Semester	Form of instruction	No. of hours	w tym e-learning	Type of credit	ECTS
3	5	laboratory	45	0	pg	4
		lecture	15	0	e	
Total			**60**			**4**

Course / module coordinator	**dr Anna Kujawska**
Course instructor	**dr Anna Kujawska**
Course / module objectives	**Familiarizing students with different types of cultures and techniques of in vitro work. Acquisition of practical skills in sterile work with plant material and plant propagation in vitro.**
Prerequisites	**Basic knowledge of Plant Embryology, Plant Physiology, Biochemistry, Microbiology.**

LEARNING OUTCOMES

Category	No.	Code	Description	Ref. to programme benchmarks
knowledge	1	EP1	the student understands the basic phenomena and processes in the field of in vitro plant cultures	K_W02
	2	EP2	the student has knowledge of the basic techniques used in plant in vitro cultures	K_W11
	3	EP3	the student knows Polish companies that produce plants in vitro	K_W15 K_W16
skills	1	EP4	the student is able to perform calculations necessary for the preparation of culture media	K_U03 K_U08
	2	EP5	the student is able to draw conclusions based on the obtained experimental results	K_U02 K_U03 K_U04 K_U09
	3	EP6	the student is able to use the available laboratory equipment to prepare and conduct experiments	K_U01
	4	EP7	the student is able to prepare a report on the conducted experiments in the form of a report	K_U15
	5	EP8	the student is able to interact and work in a group, assuming different roles in it	K_U16
social competences	1	EP9	The student acquires the competence to comply with the health and safety rules while working in the laboratory	K_K05

CONTENT	Semester	No. of hours	w tym e-learning
Subject title: **In vitro culture of plant**			
Format of instruction: **lecture**			

1. In vitro cultures in basic research and agriculture.	5	2	0
2. Principles of using in vitro culture techniques.	5	2	0
3. Culture types.	5	2	0
4. Direct and indirect organogenesis.	5	2	0
5. Somatic embryogenesis.	5	2	0
6. Plant micropropagation.	5	2	0
7. Releasing plants from viruses.	5	2	0
8. Gynogenesis and androgenesis.	5	1	0
Format of instruction: **laboratory**			
1. **Mathematical calculations related to the preparation of media**	5	5	0
2. **Preparation of culture media**	5	6	0
3. **Surface sterilization of plant material**	5	4	0
4. **Cultures of isolated organs**	5	5	0
5. **Callus cultures of selected plant species**	5	6	0
6. **Induction of organogenesis on the example of selected plant species**	5	6	0
7. **Micropropagation of selected plant species**	5	9	0
8. **Acclimatization of selected plant species**	5	4	0

Modes of delivery	**multimedia presentation** **work in groups** **performing experiments** **solving tasks**	
Assessment methods		No. of learning outcome from the syllabus
	WRITTEN EXAM	**EP1,EP3**
	KOLOKWIUM	**EP2,EP4,EP5**
	EXAM	**EP5,EP7**
	PRACTICAL CLASSES	**EP6,EP8,EP9**
Grading criteria	**Lectures:** **Written exam to check the knowledge acquired during the lectures (longer written statement)** **Exercises:** **Determining the final grade on the basis of partial grades received during the semester for the colloquium, report, as well as on the basis of the student's activity in classes** **The final grade is the average of grades from lectures and exercises in the ratio of 2:1**	
	Grade calculation principles	
	The final grade of the course coordinator is 33% of the grade for laboratory exercises and 67% of the grade for lectures.	

Final grade calculation method	Sem.	Course	Type of credit	Grade calc. method	Weight for the average
	5	In vitro culture of plant		weight	
	5	In vitro culture of plant [lecture]	exam		0,33
	5	In vitro culture of plant [laboratory]	pg		0,67

Basic reading	Bowes B. (1999): Plant Propagation and conservation, Manson Publishing, UK (dostępna w Katedrze Biotechnologii Roślin)
	George E.F. (2007): Plant Propagation by Tissue Culture: Vol1, Rozdział 9, Springer (dostępna w Katedrze Biotechnologii Roślin)
	Kępczyńska E., Kępczyński J. (1998): Biotechnologia roślin - kultury in vitro, WNP US, Szczecin
	Malepszy S. (2009): Biotechnologia Roślin, Wydawnictwo Naukowe PWN, Warszawa
Supplementary reading	Biotechnologia - Computational Biology and Bionanotechnology, Kwartalnik (wybrane numery)
	Publikacje przeglądowe w biotechnologicznych czasopismach krajowych i zagranicznych

STUDENT WORKLOAD

	No. of hours	
		W tym e-learning
Contact hours	**60**	**0**
Participation in test / exam	**4**	**0**
Preparation for contact hours	**10**	**0**
Private reading and studying	**5**	**0**
Participation in tutorials	**6**	**0**
Preparation of project / essay / etc.	**5**	**0**
Preparation for test / exam	**10**	**0**
TOTAL workload	**100**	
ECTS credits	**4**	

SYLLABUS

Subject: Molecular methods in taxonomic and population studies						
Field of study: biology						
Forma studiów: -		**Profil studiów:** -			**Specjalność: -**	
Status przedmiotu: -				**Język przedmiotu: English**		
Rok	**Semestr**	**Forma zajęć**	**Liczba godzin**		**Forma zaliczenia**	**ECTS**
				w tym e-learning		
3	5	lectures	15		exam	**4**
		laboratory	25			
Total			40	-		**4**
Coordinator:		Prof. dr hab. Andrzej Zawal				
Lecturers:		Prof. dr hab. Andrzej Zawal, Prof. Dr hab. Agnieszka Szlauer-Łukaszewska, Dr Grzegorz Michoński, Mgr Aleksandra Bańkowska, dr Jakub Skorupski				
Aim:		The aim of the course is to familiarize students with the methods of determining relationships between and within species and population characteristics based on molecular data.				

LEARNING OUTCOMES

knowledge	1	The student defines the subject and scope of phylogenetic and population research	
	2	The student knows and understands at an advanced level the relationships of molecular research enabling understanding the principles of functioning of organisms at the species and population level. and interpreting and generalizing the possessed knowledge.	
skills	1	The student is able to properly perform and interpret the analysis of relationship, critically analyzing and evaluating them, and to synthesize the data contained therein to formulate and solve problems	
	2	Can properly select and apply molecular data for intra-population and inter-species analyzes, and can present the results of observations and conclusions, including the analysis of professional literature, in written and oral form, using advanced information and communication techniques	
Social competence	1	Student is willing to critically evaluate his knowledge and recognize the importance of general and specialist knowledge of molecular research in taxonomy and population studies in solving cognitive and practical problems, and to consult experts in the event of difficulties in solving problems on his own.	

L.p	**Content of classes**		
1	Various data used in phylogenetic and population analyzes.		
2	Taxonomic value of genetic traits at different levels of organisms classification.		
3	Philogeography, dispersion and specialization		
4	Population characteristics, demography, gene flow, population development		

Modes of delivery	multimedia presentation	
Methods of assessment	Written exam	

Grading criteria	The condition for obtaining estimation is participation in lectures and a passing the exam
Literature	
	Joanna R. Freeland, Heather Kirk, Stephen Petersen 2011. Molecular Ecology, Second Edition. John Wiley & Sons, Ltd
	Avise, J. C. (2004); Molecular Markers, Natural History and Evolution.
	Barry G. Hall. 2008. Phylogenetic Trees Made Easy: A How-to Manual, third edition. Sinauer Associates, Sunderland, Massachusetts.
ECTS credits	**4**

Subject: **Paleoecology**			
Field of study: biology			
Form of classes	*Class hours*	*ECTS*	*Language*
lecture	10	2	English
practical classes	15		
Coordinator:	dr hab. Małgorzata Puc, prof. US		
Objectives of the subject:	Familiarization with selected aspects of environmental paleoecology, with particular emphasis on paleopalynology and with the ecology of fossil plants. Providing knowledge about the relationship between the structure and functions of fossil organisms and their adaptations to the environment		
Requirement:	Knowledge of biology from secondary school		

Program content

Program content of lectures

1. Paleoecology as a field of paleontology (2h)
2. Reconstruction of the paleoenvironment and research into the mechanisms determining the changes in the natural environment on a global, regional and local scale (3h)
3. Ecology of fossil plant species. Relationships between the structure and functioning of fossil organisms and their adaptations to the environment (4h)
4. Outline of changes in the natural environment of Europe in the Quaternary against the background of the theory of climate and climate cycles
edaphic; changes in Poland's natural environment after the end of the last glaciation (3h)
5. Research methods in paleoecology: palaeobotanical lithology; absolute and relative dating (3h)

Program content of practical classes

1. Practical application of indoor air quality research methods (3h)
2. Preparation of microscopic slides (2h)
3. Pollen analysis. Structure and recognition of pollen grains of fossil species (4h)
4. Comparison of the structure of fossil pollen with modern pollen in analogous taxa (3h)
5. POLPAL pollen diagrams, isofield map analysis (3h)

Educational methods	- multimedia presentation - individual observation under a microscope
Form and conditions of passing the subject	- completion of lectures: final written test - knowledge from lectures and recommended literature - completion of practical classes: practical passing of microscopic observation (recognition of pollen and paleospores) as well as drawing in a notebook - final evaluation: arithmetic mean of grades (test results for passing lectures and practical classes)
Literature	-Darin A. Croft, Denise F. Su, Scott W. Simpson. (2018) Methods in Paleoecology. Springer. - David J. Bottjer. (2016) Paleoecology: Past, Present and Future. Wiley-Blackwell.

	- Warren D. Allmon and David J. Bottjer. (2001) Evolutionary Paleoecology. Columbia University Press. -Aerobiologia, Grana, Acta Agrobotanica, AAEM, Atmospheric Environment, Biogeociences, Int., J. Biometeorology

<table>
<tr><td colspan="4">*Subject*: Statistical methods in biology</td></tr>
<tr><td colspan="4">*Field of study*: biology</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td></td><td></td><td rowspan="2">2</td><td rowspan="2">English</td></tr>
<tr><td>laboratories</td><td>25</td></tr>
<tr><td>*Year/Semester*</td><td colspan="3">2/3</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">Dr hab. inż. Przemysław Śmietana, prof US</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">In this introductory statistics course we will explore the use of statistical methodology in designing, analysing, interpreting, and presenting biological experiments and observations. We will cover descriptive statistics, elements of experimental design, probability, hypothesis testing and statistical inference, analysis of variance, correlation, regression techniques, and non-parametric statistical methods. Throughout the course the application of statistical techniques within a biological context will be emphasized, using data from laboratory and field studies.</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">Basic knowledge of: ecology, the basics genetics, nature conservation.</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">students will emerge from the Biostatistics course with many new tools at their disposal, including being able to:
• construct and interpret graphical displays such as histograms, box plots, bar charts,
• calculate and interpret summary statistics for data sets,
• recognize basics of experimental design, including controls,
• appreciate the logic (convoluted) of statistical inference,
• construct and correctly interpret confidence intervals around point estimates,
• understand the proper use and interpretation of significance levels (p values),
• recognize and understand the relevance of probability distributions such as the normal & binomial,
• be able to formulate and test statistical hypotheses using 5 steps,
• recognize the situations when it is appropriate to use, and be able to perform: two-sample (independent or paired) t-tests, one factor analysis of variance, simple linear regression analysis, correlation, goodness of fit tests,
• know the conditions (assumptions) required for the validity of the above tests, and know which non-parametric alternatives can be used when such assumptions are not met
• know how to write a concise explanation of your statistical results,
• know how to use statistical software such as *Excel*, *Statistica* or *R* to describe biological data and to test specific biological hypotheses.</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• work in groups,
• individual work,
• multimedia presentation,
• work with computers</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">Written exam</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Moore, D. & McCabe G., Introduction to the Practice of Statistics, 9th Edition. Freeman, 2017.
2. Newbold, P., Statistics for Business and Econometrics. Prentice
3. Barbara Illowsky B., Dean S., Chiappetta L., Introductory Statistics. OpenStax. 2013</td></tr>
</table>

	4. Rosner B., Fundamentals of Biostatics) 7th Edition, 2015 5. Zar, J.,H., Biostatistical analysis. Fifth edition. Pretince-Hall, Inc. 2010

SYLLABUS

Subject code: SPR23AIJ3446_5S						
Subject name: Zoology of invertebrates						
Field of study: biology						
Forma studiów:-		**Profil studiów:** -			**Specjalność: -**	
Status przedmiotu: podstawowy				**Język przedmiotu: English**		
Rok	**Semestr**	**Forma zajęć**	**Liczba godzin**		**Forma zaliczenia**	**ECTS**
				w tym e-learning		
1	2	lecture	30		exam	**7**
		laboratory	45			
		Field classes	10			
RAZEM				-		**7**

Koordynator przedmiotu:	Prof. dr hab. Andrzej Zawal
Prowadzący zajęcia:	Prof. dr hab. Andrzej Zawal, Prof. Dr hab. Agnieszka Szlauer-Łukaszewska, Dr Grzegorz Michoński, Mgr Aleksandra Bańkowska
Cele przedmiotu:	The aim of the course is to familiarize students with the systematics, taxonomy and biology of invertebrates. After completing the course, the student knows the systematics, morphology and anatomy of basic groups of invertebrates and is able to recognize individual taxa of higher rank.
Wymagania wstępne:	

EFEKTY UCZENIA SIĘ

Kategoria	**L.p.**	**Opis efektu**	**Odniesienie do efektów dla programu**
wiedza	1	Student knows and understands at an advanced level selected facts, concepts and complex relationships between them and explaining theories, constituting the basic general knowledge in the field of natural sciences, forming the basis of zoology.	K_W01
	2	Student knows and understands at an advanced level the relationships of zoology and taxonomy of invertebrates with other natural disciplines, enabling the understanding of the principles of functioning of organisms as well as the interpretation and generalization of knowledge	K_W03
umiejętności	1	Student is able to properly select and use sources of scientific information, critically analyze and evaluate them, and synthesize the data contained therein to formulate and solve problems	K_U02
	2	Student is able to properly select and use appropriate research methods and tools, and present the results of observations and conclusions, including the analysis of professional literature, in written and oral form, using advanced information and communication techniques	K_U03
kompetencje społeczne	1	Student is ready to critically evaluate his knowledge and perceived content, and to recognize the importance of general and specialist knowledge in invertebrate zoology in solving cognitive and practical problems, and to consult experts in the event of difficulties in solving problems on his own.	K_K02

CONTENT

Forma zajęć: lecture

L.p.	Treści	semestr	liczba godzin
1	Metazoa - taxonomy, theories of origin, animal archtecture.	II	
2	Parazoa, Cnidaria	II	
3	Parenchymata, Pseudocelomata, Annelida	II	
4	Crustacea, Chelicerata	II	
5	Insecta	II	
6	Mollusca	II	
7	Echinodermata	II	

Metody kształcenia:	multimedia presentation	
Metody weryfikacji efektów uczenia się		**Nr efektu uczenia się z sylabusa**
	Written exam	K_W01 K_W03 K_U02 K_U03 K_K02
Forma i warunki zaliczenia	The condition for obtaining estimation is participation in lectures and a passing the exam	

Metoda obliczania oceny końcowej		**Przedmiot / forma**	**Rodzaj zaliczenia**	**Metoda obliczania oceny**	**Waga do średniej**
		Lecture	exam		

Literatura podstawowa	
	Richard C. Brusca, Gary J. Brusca (2003) Invertebrates. 2nd Edition. Sinauer Associates, Inc., Publishers
Literatura uzupełniająca	

NAKŁAD PRACY STUDENTA

	Liczba godzin
Zajęcia dydaktyczne	85
Udział w egzaminie/zaliczeniu	5
Przygotowanie się do zajęć	15
Studiowanie literatury	20
Udział w konsultacjach	20
Przygotowanie projektu / eseju / itp.	10
Przygotowanie się do egzaminu / zaliczenia	20
Łączny nakład pracy studenta w godz.	175
Liczba punktów ECTS	**7**

<table>
<tr><td colspan="4">*Course*: Biowarfare, Bioterrorism and Biocrime</td></tr>
<tr><td colspan="4">*Field of study*: Microbiology, Genetics and Experimental Biology, Biology</td></tr>
<tr><td>*Class format*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>Lectures</td><td>10</td><td rowspan="2">3</td><td rowspan="2">English</td></tr>
<tr><td>Practicals</td><td>20</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">Jakub Skorupski, PhD, Eng.</td></tr>
<tr><td>*Course objectives:*</td><td colspan="3">Familiarizing students with the issues of bioterrorism, the main pathogens used in bioterrorist attacks, methods and instruments for detecting and counteracting threats from bioterrorism and the rules of conduct in the event of a bioterrorist attack.</td></tr>
<tr><td>*Requirements*:</td><td colspan="3">Basic knowledge of biology.</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Introduction to the issue of biowarfare, bioterrorism and biocrime – definitions, international law
2. History of bioweapon
3. Types and recognition of bioterrorist attacks
4. Biosecurity levels
5. Biological weapons - introduction. Modern diagnostic techniques in the detection and identification of biological weapons
6. Exotoxins produced by *Bacillus anthracis* and *Clostridium botulinum* bacteria
7. Dangers resulting from tularemia and brucellosis infection
8. Dangers resulting from infection with plague and cholera
9. Pox virus and viral hemorrhagic fevers. Other biological substances that can be used as biological weapons
10. Procedure in the event of a bioterrorist attack</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• lecture
• multimedia presentation
• problem discussion
• case study analysis
• critical discussion</td></tr>
<tr><td>*Course approval format and condition*</td><td colspan="3">Written test</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Flora S.J.S. 2019. Handbook on Biological Warfare Preparedness. Academic Press Inc. New York</td></tr>
</table>

	2. Chrystal P. 2023. Bioterrorism and Biological Warfare: Disease as a Weapon of War. Pen & Sword Military. Barnsley 3. Chiodo E.P. 2013. Bioterrorism. Xlibris. Bloomington 4. Hank E.D. 2022. Handbook of Chemical and Biological Warfare Agents, Volume 1: Military Chemical and Toxic Industrial Agents. CRC Press Inc. Boca Raton

<table>
<tr><td colspan="4">*Subject*: Conservation ecology</td></tr>
<tr><td colspan="4">*Field of study*: biology</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>lectures</td><td>10</td><td rowspan="3">4</td><td rowspan="3">English</td></tr>
<tr><td>laboratory</td><td>20</td></tr>
<tr><td>field trip</td><td>15</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">dr inż. Jakub Skorupski</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">familiarization with theories and concepts of ecological foundations of preservation and management of biodiversity and natural resources</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">Basics of general biology and ecology</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Introduction to conservation ecology. Conservation ecology as the branch of ecology and evolutionary biology
2. Preservation and management of biodiversity and natural resources. Restoration ecology – restoration, reintroduction, rewilding
3. Defining units of conservation
4. Ecological connectivity. Landscape genetics
5. Biological invasions
6. Ecosystem services
7. Sustainable development concept
8. Green and blue infrastructure
9. Inventory and valorisation of natural resources. Wildlife monitoring
10. Guided field trip – rewilding in action</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• lecture
• multimedia presentation
• *in silico* analyses/specialized software
• work in groups
• problem discussion
• case study analysis</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">Written exam</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Fryxell J.M., Sinclair A.R.E., Caughley G. 2014 (or previous editions). Wildlife Ecology, Conservation, and Management. Wiley-Blackwell. Hoboken
2. Lovejoy T.E., Hannah L., Wilson E.O. 2019. Biodiversity and Climate Change: Transforming the Biosphere. Yale University Press. London
3. Holl K. 2020. Primer of Ecological Restoration. Island Press. Washington</td></tr>
</table>

	4. Skorupski J. (ed.) et al. 2017. Invasive Alien Species – identification of threats to protect biodiversity. Polish Society for Conservation Genetics LUTREOLA. Szczecin 5. Global Ecology and Conservation (Elsevier)

<table>
<tr><td colspan="4">*Subject*: Genomics</td></tr>
<tr><td colspan="4">*Field of study*: Genetics and experimental biology, 1st degree, winter semester</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>Lectures</td><td>10</td><td rowspan="3">3</td><td rowspan="3">English</td></tr>
<tr><td>Laboratory</td><td>20</td></tr>
<tr><td>field trip</td><td>0</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">dr inż. Jakub Skorupski</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">familiarization with the tools and principles of contemporary genomics, including a working knowledge of current genomics technology and approaches as well as the types of databases and computational tools available</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">A familiarity with basic biochemistry, genetics, and molecular and cellular biology</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Course introduction, introduction to genomics
2. Contents, organization, and dynamics of genomes. The human genome
3. Genome sequencing
4. Genome assembly, mapping reads and pairwise alignment
5. Sequence modelling, prediction and genome annotation
6. Population genomics
7. Metagenomics
8. Phylogenomics. Evolutionary genomics. Paleogenomics
9. Conservation genomics
10. Functional genomics. Transcriptomics
11. Genome-wide association studies
12. Current status, future opportunities, and remaining challenges in genomics</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• Lecture
• multimedia presentation
• *in silico* analyses/specialized software
• work in groups
• problem discussion
• case study analysis</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">Written exam</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Brown T.A. 2023. Genomes. CRC Press. Boca Raton
2. Allendorf F.W. 2022 (or previous editions). Conservation and the Genomics of Populations. Oxford University Press. Oxford
3. International Human Genome Sequencing Consortium. 2001. Initial sequencing and analysis of the human genome. Nature 409: 860
4. Pevsner J. 2015. Bioinformatics and Functional Genomics. Wiley John&Sons Inc. Hoboken
5. Lesk A. 2017. Introduction to Genomics. Oxford University Press. Oxford
6. Boyle A. 2022. Essentials of Human Genomics. American Medical Publishers. New York</td></tr>
</table>

<table>
<tr><td colspan="4">*Subject*: Introduction to Conservation Biology</td></tr>
<tr><td colspan="4">*Field of study*: biology</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>lectures</td><td>10</td><td rowspan="3">4</td><td rowspan="3">English</td></tr>
<tr><td>laboratory</td><td>20</td></tr>
<tr><td>field trip</td><td>15</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">dr inż. Jakub Skorupski</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">familiarization with theories and concepts of importance for assessing the viability and status of plant and animal populations, in particular, the effects of population size on demographic and genetic processes that influence extinction risk</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">Basics of general biology and ecology</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Defining conservation biology
2. Forms and patterns of biodiversity
3. Valuing biodiversity
4. Extinction – rates and patterns
5. Causes of population decline – habitat fragmentation, degradation and loss, pollution, overexploitation, invasive non-indigenous species, disease
6. Global change. Climate Change, , Invasive Species, Disease
7. Populations and habitats management. Species conservation. Protected areas. *Ex situ* and *in situ* conservation efforts. Restoration
8. Conservation categories. The IUCN Red List of Threatened Species
9. Conservation law
10. Guided field trip – valuing biodiversity in practice</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• lecture
• multimedia presentation
• *in silico* analyses/specialized software
• work in groups
• problem discussion
• case study analysis</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">Written exam</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Allendorf F.W. 2022 (or previous editions). Conservation and the Genomics of Populations. Oxford University Press. Oxford
2. Sodhi N.S. (ed.), Ehrlich P.R. (ed.). 2010. Conservation Biology for All. Oxford University Press. Oxford
3. Skorupski J. (ed.) et al. 2017. Invasive Alien Species – identification of threats to protect biodiversity. Polish Society for Conservation Genetics LUTREOLA. Szczecin</td></tr>
</table>

	4. Conservation Biology journal (The Society for Conservation Biology) 5. Conservation Letters journal (The Society for Conservation Biology)

<table>
<tr><td colspan="4">*Subject*: Introduction to conservation genetics</td></tr>
<tr><td colspan="4">*Field of study*: biology</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>lectures</td><td>10</td><td rowspan="3">4</td><td rowspan="3">English</td></tr>
<tr><td>laboratory</td><td>20</td></tr>
<tr><td>field trip</td><td>15</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">dr inż. Jakub Skorupski</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">familiarization with the theoretical and practical foundations of gene pool protection in order to preserve biodiversity and ensure the continuity of evolutionary and ecological processes responsible for its development and maintenance</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">Basics of genetics and molecular biology</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Introduction to conservation genetics – terminology, methodology, position in the family of genetic sciences and among the branches of conservation biology
2. Analysis of genetic determinants of the most important threats to biodiversity
3. Application of genetics in the practice of nature conservation – application potential of conservation genetics
4. Protection of genetic resources of wild animals and plants
5. Legal and ethical aspects of conservation genetics
6. Application of molecular genetic methods in nature conservation
7. Application of *in silico* analyses in conservation genetics
8. Planning *ex situ* and *in situ* conservation activities based on conservation genetics
9. Controversial concepts within conservation genetics – de-extinction and conservation breeding improvement
10. Guided field trip to a conservation breeding centre for endangered species</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• lecture
• multimedia presentation
• *in silico* analyses/specialized software
• work in groups
• problem discussion
• case study analysis</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">Written exam</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Allendorf F.W. 2022 (or previous editions). Conservation and the Genomics of Populations. Oxford University Press. Oxford
2. Frankham R. 2010. Introduction to Conservation Genetics. Cambridge University Press. Cambridge
3. Ballou J.D., Briscoe D.A., Frankham R. 2009. A Primer of Conservation Genetics. Cambridge University Press. Cambridge</td></tr>
</table>

	4. Skorupski J. (ed.) et al. 2017. Conservation genetics in Poland – theory and practice. Polish Society for Conservation Genetics LUTREOLA. Szczecin 5. Conservation Genetics journal (Springer)

<table>
<tr><td colspan="4">*Subject*: Mitogenomics</td></tr>
<tr><td colspan="4">*Field of study*: Genetics and experimental biology, 1st degree, winter semester</td></tr>
<tr><td>*Form of classes*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>Lectures</td><td>10</td><td rowspan="3">3</td><td rowspan="3">English</td></tr>
<tr><td>Laboratory</td><td>20</td></tr>
<tr><td>field trip</td><td>0</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">dr inż. Jakub Skorupski</td></tr>
<tr><td>*Objectives of the subject:*</td><td colspan="3">familiarization with the tools and principles of mitogenomics, including a working knowledge of current mitogenomics technology and approaches as well as the types of databases and computational tools available</td></tr>
<tr><td>*Requirement:*</td><td colspan="3">A familiarity with basic biochemistry, genetics, and molecular and cellular biology</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Course introduction, introduction to mitochondrial genomics
2. Contents, organization, and dynamics of mitogenomes
3. Mitochondrial genome sequencing and annotation
4. Online resources to explore mitochondrial genomics
5. Mitogenome evolution
6. Population mitogenomics
7. Phylomitogenomics
8. Clinical mitogenomics
9. Comparative mitogenomics
10. Mito-nuclear discordance and mtDNA in nuclear DNA
11. Use of mitochondrial genome in forensics
12. Current status, future opportunities, and remaining challenges in mitogenomics</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• Lecture
• multimedia presentation
• in silico analyses/specialized software
• work in groups
• problem discussion
• case study analysis</td></tr>
<tr><td>*Form and conditions of passing the subject*</td><td colspan="3">Written exam</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Gasparre G., Porcelli A.M. 2020. The Human Mitochondrial Genome. From Basic Biology to Disease. Elsevier Inc. Amsterdam
2. Nicholls T.J., Uhler J.P., Falkenberg M. 2023. Mitochondrial DNA. Methods and Protocols. Springer. Berlin
3. McCormick E.M., Muraresku C.C., Falk M.J. Mitochondrial Genomics: A complex field now coming of age. Curr. Genet. Med. Rep. 2018 6(2): 52-61
4. Silva-Pinheiro P., Minczuk M. 2022. The potential of mitochondrial genome engineering. Nat. Rev. Genet. 23: 199-214
5. Cappa R., de Campos C., Maxwell A.P., McKnight A.J. 2020. “Mitochondrial Toolbox” – A Review of Online Resources to Explore Mitochondrial Genomics. Front. Genet. 11: 439
6. Skorupski J. 2022. Characterisation of the Complete Mitochondrial Genome of Critically Endangered Mustela lutreola (Carnivora: Mustelidae) and Its Phylogenetic and Conservation Implications. Genes 13(1): 125</td></tr>
</table>

<table>
<tr><td colspan="4">*Course*: Molecular population genetics</td></tr>
<tr><td colspan="4">*Field of study*: Genetics and Experimental Biology, Biology, Microbiology</td></tr>
<tr><td>*Class format*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>Lectures</td><td>10</td><td rowspan="2">3</td><td rowspan="2">English</td></tr>
<tr><td>Practicals</td><td>20</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">Jakub Skorupski, PhD, Eng.</td></tr>
<tr><td>*Course objectives:*</td><td colspan="3">The course aims to explore evolutionary processes through the application of population and quantitative genetic models within a molecular framework. It seeks to enhance students' ability to predict genetic changes using mathematical and statistical principles, understand the molecular factors driving genetic variation, and build a strong foundation in quantitative genetics.</td></tr>
<tr><td>*Requirements*:</td><td colspan="3">General knowledge on principles of genetics and statistics.</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Molecular aspects of genetic and phenotypic variation
2. Hardy-Weinberg Equilibrium
3. Genetic linkage and population genetics
4. Random genetic drift
5. Mating system, inbreeding, outbreeding, gene flow
6. Molecular markers and population genetics
7. Genetic differentiation, mutation
8. Population subdivision and migration, Wahlund effect, F statistics, genetic distance
9. Models of population structure – molecular dimension
10. Principles of population genomics</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• lecture
• multimedia presentation
• *in silico* analyses/specialized software
• work in groups
• problem discussion
• case study analysis
• critical discussion</td></tr>
<tr><td>*Course approval format and condition*</td><td colspan="3">Written test</td></tr>
<tr><td>*Literature*</td><td colspan="3">1. Hahn M.W. 2018. Molecular Population Genetics. Oxford University Press Inc. Oxford</td></tr>
</table>

	2. Hartl D.L. 2020. A Primer of Population Genetics and Genomics. Oxford University Press Inc. Oxford 3. Cutter A.D. 2019. A Primer of Molecular Population Genetics. Oxford University Press Inc. Oxford 4. Templeton A.R. 2021. Population Genetics and Microevolutionary Theory. Blackwell Publishing. Hoboken

<table>
<tr><td colspan="4">*Course*: Natural Hazards</td></tr>
<tr><td colspan="4">*Field of study*: Protection and Engineering of the Natural Environment, Biology</td></tr>
<tr><td>*Class format*</td><td>*Class hours*</td><td>*ECTS*</td><td>*Language*</td></tr>
<tr><td>Lectures</td><td>10</td><td rowspan="2">3</td><td rowspan="2">English</td></tr>
<tr><td>Practicals</td><td>20</td></tr>
<tr><td>*Coordinator:*</td><td colspan="3">Jakub Skorupski, PhD, Eng.</td></tr>
<tr><td>*Course objectives:*</td><td colspan="3">The course aims to examine the disaster cycle – mitigation, preparation, response, and recovery – in the context of the interaction between natural hazards, such as floods, droughts, and earthquakes, and human society. It focuses on understanding the causes and impacts of natural disasters, with an emphasis on their ecological dimensions, including how ecosystems influence hazard dynamics and resilience. Students will explore the role of human activity in exacerbating or mitigating disaster risks and develop strategies for sustainable disaster management that balance societal needs with ecological conservation.</td></tr>
<tr><td>*Requirements*:</td><td colspan="3">General knowledge on ecology.</td></tr>
<tr><td colspan="4">*Program content*</td></tr>
<tr><td colspan="4">1. Overview of natural hazards and disasters: definitions, classification, historical trends, and global impacts.
2. The disaster cycle: mitigation, preparation, response, and recovery.
3. Geological hazards: earthquakes, tsunamis, volcanic eruptions, and landslides.
4. Hydrological and meteorological hazards: floods, droughts, storm surges, hurricanes, tornadoes, and extreme weather events.
5. Ecological hazards: wildfires, pest outbreaks, habitat degradation, and their links to natural disasters.
6. Ecological dimensions of hazards: the role of ecosystems in hazard regulation, impacts on biodiversity, and ecosystem-based disaster risk reduction.
7. Human influence on hazards: urbanization, deforestation, climate change, and their role in increasing hazard risks.
8. Methods for hazard mapping and vulnerability assessment.
9. Risk management strategies: mitigation, response, cost-benefit analysis, and sustainable disaster planning.
10. Advances in technology for hazard monitoring, forecasting, and early warning systems.
11. Climate change and its implications for the frequency and intensity of future natural hazards.
12. Case studies of significant natural disasters: societal and ecological impacts, lessons learned, and best practices.</td></tr>
<tr><td>*Educational methods*</td><td colspan="3">• lecture
• multimedia presentation</td></tr>
</table>

	• *in silico* analyses/specialized software • work in groups • problem discussion • case study analysis • critical discussion
Course approval format and condition	Written test
Literature	1. Abbott P.L. 2022. Natural Disasters. McGraw-Hill Education. New York 2. Hill L. 2022. Natural Hazards and Disaster Management. Callisto Reference. Forest Hills 3. Hyndman D.W. 2016. Natural Hazards and Disasters. Cengage Learning Inc. Boston