



## COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Kodas
Methodology of Ecology Research	

Annotation
<p>The course is intended for master's students of natural systems management, seeking to strengthen modern ecology and environmental research methodologies responsible and critical choice of assessment methods for natural and semi-natural ecosystems. Master students are introduced to research methodology, the research process, its structure, theoretical and empirical methods and principles in research. The concepts of validity, reliability, objectivity and representativeness of measurements are analyzed with practical examples of research. Research planning, data analysis and presenting methods are discussed. The right preparation of the research report, typical errors in the research reports and research ethics issues are discussed. During the seminars the methodological analyzes of scientific publications in the field of ecology are performed, the instruments of the planned research are created and substantiated and the methodological substantiations of the planned research are performed.</p> <p>The practical skills and the ability to responsibly select and critically evaluate natural and semi-natural ecosystems are developed. Students deepen into the methods of chemical analysis and wildlife monitoring applied in ecosystem research, perform practical work, statistically evaluate the obtained results and summarize them.</p>

Lecturer(s)	Department(s) where the course unit (module) is delivered
<b>Coordinator:</b> Dr. Ilona Kerienė  <b>Other(s):</b> Assoc. prof. dr. Violeta Štekienė	Šiauliai Academy

Study cycle	Type of the course unit (module)
Second study cycle	Compulsory

Mode of delivery	Semester or period when the course unit (module) is delivered	Language(s) of instruction
Blended learning	First semester	Lithuanian, English

Requisites	
<b>Co-requisites (if relevant):</b> knowledge in ecology	<b>Additional requirements (if any):</b>

Number of ECTS credits allocated	Student's workload (total)	Contact hours	Individual work
5	140	38	102

Purpose of the course unit (module)
<p>Purpose: To prepare to perform ecological research and master's thesis in a qualified manner, strengthen theoretical and practical modern ecology and environmental sciences research methodologies fundamentally and critically choose methods for assessing natural and semi-natural ecosystems, and develop a research culture through practical experience. Upon completion of this course, students will acquire a minimum of research modelling concepts, knowledge of ecological research methods and principles, their strategic types, data processing techniques, research planning and performance. In addition, students will be able to study specialized scientific literature and continuously study and deepen their skills in ecological activities. Students will know the principles of ecosystem research in laboratories. They will be able to critically evaluate information on research methods used to assess the condition of ecosystems, select advanced technologies to assess the condition of ecosystems and develop research and personal time planning skills.</p>

Learning outcomes of the course unit (module)	Teaching and learning methods	Assessment methods
- develop the ability to evaluate the information critically; considering the forecasting alternatives, a student will convey conclusions and recommendations on the applied methods for assessing the condition of natural systems to specialists and non-specialists.	Discussion, information retrieval tasks, analysis of scientific literature, practical tasks, traditional lecture.	Group homework, Individual homework, An unconventional task.
- deepen the professional skills as an ecologist by systematising the latest and most relevant information on research methods and principles, data processing methods and scientific work planning.	Analysis of a scientific article, practical tasks, discussion.	Case study, group homework.
- will assess the state of ecosystems using modern research methods, process and communicate the results of ecological research in various ways (graphical, tabular, schematic), evaluate their accuracy and link them with theoretical models.	Practical tasks, application of special software packages, practical tasks, discussion.	Practical work report and work defense, group work, activity reflection.

Content: breakdown of the topics	Contact hours							Individual work: time and assignments		
	Lectures (e-learning)	Tutorials	Seminars	Workshops	Laboratory work	Internship/work placement	E-learning	Contact hours, total	Individual work	Assignments
The concept of research methodology. Research process. Theoretical methods and principles in research. Empirical methods and principles in research.	2							2	15	Information retrieval and analysis
Validity of measurements, reliability, objectivity, representativeness. Data analysis. Research planning. Structure of the research process.	2							2	15	Information retrieval and analysis
Preparation of research report. Research ethics issues. The methodological analysis of scientific publications in the field of ecology.	2		4					6	15	The methodological analysis of the planned research topic of the master's thesis
Methods for the analysis of chemical components in ecosystems: - the REACH Regulation, -sample preparation methods, -chemical analysis methods and equipment.	1			10				11	15	Source 2. Chapters 2, 3,4, 8 Practical work: Application of chemical analysis methods in ecosystem research.
Methods for the analysis of biological components in ecosystems: - a collection of field test samples, preparation for analysis, equipment used,	1			10				11	15	Source 2. Chapter 10. Practical work: Application of molecular and microscopic

- molecular test methods, - work with advanced microscopy equipment.									methods in ecosystem research.	
Development of a research instrument and its methodological substantiation. Methodological substantiation of the intended ecological study.			6					6	27	Methodological substantiation of the planned research of the master's thesis.
<b>Total</b>	<b>8</b>		<b>10</b>	<b>20</b>				<b>38</b>	<b>102</b>	

Assessment strategy	Weight, %	Deadline	Assessment criteria
Information search and methodological analysis of a scientific publication on the topic of the master's thesis.	20 %	3	<p>A scientific publication relevant to the master's thesis is selected, a report is methodologically analysed, and a report is prepared.</p> <p>The relevance of the selected scientific publication to the master's thesis and the quality and presentation of the methodological analysis of the publication are assessed.</p> <p>9-10 demonstrates excellent preparation for a given topic. The selected publication fully corresponds to the topic of the future master's thesis and is properly methodologically analyzed, i.e. the structure of the article, its relevance, novelty, appropriate connections between the title, hypotheses, goals and objectives of the article, applied research methods and instruments, depth of conclusions and generalizations, literature sources and their citation method are analysed. During the presentation of the task, the student correctly uses the concepts and terms of research methodology, argues his / her opinion, makes suggestions, and actively participates in discussions.</p> <p>7-8 - Demonstrates good preparation for a given topic. The selected publication corresponds to the topic of the future master's thesis and is well methodologically analysed, i.e. the structure of the article, its relevance, the connections between the title, hypotheses, goals and objectives of the article are discussed. The applied research methods and instruments are presented, and conclusions, literature sources, and citations are discussed, but most parts lack deeper analysis, arguments, or insights. During the presentation of the task, the student uses the concepts and terms of research methodology partially correctly, lacks arguments to substantiate his / her opinion, but is able to make suggestions and participate in discussions.</p> <p>6-5 - Demonstrates adequate/poor preparation on a given topic. The selected publication only partially corresponds to the future master's thesis topic. It is satisfactorily or weakly methodologically analyzed, i.e. poorly analysed structure of the article, poorly discussed relevance of the article and connections between the title of the article, hypotheses, goals and objectives, unanalysed or weakly analysed applied research methods and instruments, conclusions, literature sources and their citation method. All parts of the work have significant shortcomings. The student during the presentation is a poorly used task in the concepts and terms of research methodology. There is a lack of arguments to substantiate his / her opinion. The student joins the discussion only when instructed by the instructor.</p> <p>3-4 - the work does not correspond to implementing the goals set for the task. The student weakly applies theoretical</p>

			<p>knowledge, does not know the terms, cannot substantiate his opinion, and does not participate in the discussion. 1-2 student work is not related to the task.</p>
Methodological substantiation of the planned research of the master's thesis	30	16-20	<p>The student's ability to perform the tasks planned for practical work, prepare a work report and defend the work is assessed. Two practical assignments are required. Each assignment has 25% weighted points.</p> <p>9-10 - demonstrates preparation for the indicated topic, performs practical work independently, correctly applies research methods and achieves the set goals. The report contains all the parts specified by the lecturer. All the results are described, summarised and correctly mathematically processed, reasoned conclusions are made, and suggestions for solving the problem are given. The student does not make spelling and language errors. The report is illustrated with original photographs by the author. The ability to express and defend their opinion demonstrates teamwork skills.</p> <p>7-8 - performs practical work independently and applies methods correctly. The report contains all the parts specified by the lecturer, and the set goals have been achieved. The results are described and summarised, there are errors in mathematical calculations, reasoned conclusions are made, and suggestions for solving the problem are given. There are spelling mistakes in the texts and language errors in the message. The report is illustrated with original photographs by the author—the ability to express their opinion, weak teamwork organisation.</p> <p>6-5 - is acquainted with the material of the practical work but turns to the lecturer to apply the research. The report contains all the parts specified by the lecturer. There are many spelling mistakes in the text. The presenter is making language mistakes. The report contains visual material. It is difficult to explain the set goals, weakly expressing one's opinion. The weak organisation of teamwork.</p> <p>4-3 - cannot explain the task and uses methods with the help of a teacher. Describes and presents the results of the study but cannot explain them. There are many spelling mistakes in the texts, many language mistakes in the presentation, weak expression of opinion. Does not know what was responsible for the task.</p> <p>1-2 - the student is slow to participate in the practical work. The report and the report are not related to the task.</p>
Methodological substantiation of the planned research of the master's thesis	30	16-20	<p>The student's ability to prepare for a master's thesis, plan and conduct research, prepare a written paper and present it to course students and lecturers is assessed.</p> <p>9-10 - The student demonstrates excellent preparation for a chosen topic: properly formulated topic, hypothesis and problem. The goal corresponds to the topic. The set tasks are in line with the goal, the relevance of the planned master's thesis is appropriately presented, arguing from the most general to the personal, planned workflow, well-chosen research methods, the relevant scientific literature corresponding to the topic of the work was selected, the list of literature was properly compiled. The written work contains all the parts formulated in the task. The student does not make spelling and language errors and can express and argue their opinion. Actively participates in discussions.</p> <p>7-8 - Demonstrates good preparation for the chosen topic. A well-formulated topic and hypothesis, the goal corresponds to the topic, the set tasks are basically in line with the goal, but</p>

			<p>some correction is needed. The relevance of the proposed master's thesis is well presented. However, the arguments are not convincing, the work process is well planned, the research methods are selected, the research instrument is not substantiated, the expected results are not specified, the relevant scientific literature is selected, but the list of literature could be more comprehensive. The student makes spelling and language mistakes. He can express their opinion but can hardly justify it. During the discussion, the student asks questions only when instructed by the instructor.</p> <p>6-5 - Satisfactory/poor preparation on the chosen topic. The formulated topic does not fit well with the goal, and the set tasks poorly reflect the content of the work; some of them are broader than the goal. The relevance of the intended master's thesis is poorly substantiated, the workflow plan requires substantial corrections, the research methods and research instrument are not selected or poorly selected and not substantiated, the expected results are not formulated or poorly formulated, and the list of scientific literature is poor. The student makes many spelling and language mistakes. He weakly expresses his opinion. During the discussion, the student asks questions only when instructed by the instructor.</p> <p>4-3 - Poor preparation for the chosen topic. The work does not correspond to implementing the goals set for the task. The written work was prepared without following the teacher's instructions. The student makes a lot of spelling and language mistakes, cannot express his / her opinion, and does not participate in discussions.</p> <p>1-2 - student work is not related to the task.</p>
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Author	Publishing year	Title	Issue of a periodical or volume of a publication; pages	Publishing house or internet site
<b>Required reading</b>				
Holmes D., Moody P., Dine D. Trueman, L.	2006	Research methods for the biosciences		Oxford university press
Mitra S., Patnaik P., Kebbekus B.B.	2019	Environmental chemical analysis.		CRC Press
<b>Recommended reading</b>				
Krebs C.J.	1999	Ecological methodology. Menlo Park : An imprint of Addison Wesley Longman		New York
Kumar R	2005	Research methodology. A step-by-step for beginners.		SAGE Publications
Ruxton G.D., Colegrave N.	2006	Experimental design for the life sciences.		Oxford university press,
Laurinavičius V.	2012	Biocheminiai analizės metodai		Vilnius, VU leidykla
Stanley E. M.	2017	Environmental chemistry		CRP Press