

Course name: TREE-RING DATING

ECTS	3
Course status	<i>optional, facultativ</i>
Course final assessment /evaluation of outcomes	<i>graded credit</i>
Prerequisite	graduated first degree programs such as Bachelor (BA or BSc.) degree in forestry, environmental protection and related fields and graduates of the academies of fine arts or archeology

Main field of study: ERASMUS+

Educational profile	General academic
Code of studies and education level	MSc
Semester of studies	winter or summer
Language of instruction	English

Course offered by:

Name of faculty offering the course	Faculty of Forestry
Name of department offering the course	Department of Forest Ecosystems Protection
Course coordinator	Bartłomiej Bednarz PhD, DSc. Eng.

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands			
LES_DATDR_W01	Has basic knowledge of dendrochronology in the world and in Poland, and defines concepts in the field of annual rings analysis. Characterizes and distinguishes research materials and is able to assess their usefulness in dendrochronological studies. Is able to describe the methods used in dendrochronology and knows the techniques of sampling from live trees and historical material. Describes the consequences of sampling for living trees and historical objects.	LES2_W04 LES2_W05 LES2_W06	RL
LES_DATDR_W02	Has basic knowledge of the principles of analysis of research material in dendrochronology. Knows the tools and techniques for preparing material for dendrochronological studies. Describes the principles of counting tree-rings as well as techniques and devices used to measure the tree-ring widths.	LES2_W04 LES2_W05 LES2_W06	RL
LES_DATDR_W03	Knows the principles of tree-ring widths analysis and dating in dendrochronological practice. Defines the theoretical basis for creating curves illustrating the variability of ring widths, including real, absolutely dated and standardized chronologies.	LES2_W04 LES2_W05 LES2_W06	RL
LES_DATDR_W04	Explains the wood dating methods and defines the most common factors affecting the accuracy of dating. Selects the right tools and methodology for dendrochronological dating. Lists examples of the use of wood dating in architecture, art, lutherie, painting, architecture as well as administrative and judicial proceedings.	LES2_W04 LES2_W05 LES2_W06	RL
SKILLS – student is able to			
LES_DATDR_U01	Is able to correctly select, use and maintain tools used in field work. Correctly choosing trees for sampling and acquires material for dendrochronological analyzes. Uses alternative, uninvasive methods of data collection to analyze the tree-rings of structural and historic wood. Colect samples from alive trees and historical wood.	LES2_U04	RL

	Correctly labeling and protects research material during transport and storage.		
LES_DATDR_U02	Has the ability to prepare wood samples for dendrochronological analyzes and is able to correctly make the cross-section of tree-rings. Can use a variety of methods to highlight the tree-rings boundaries. Measure the annual rings using traditional methods and based on digital image analysis.	LES2_U04	RL
LES_DATDR_U03	It digitizes tree-rings and supports digital incremental tools. Measures, transforms and analyzes data using the programs CooRecorder, CDendro. Verifies the results obtained by dendrochronological analysis for the occurrence of measurement errors. Is able to transform data and create individual and site, real and normalized tree-ring chronology.	LES2_U04	RL
LES_DATDR_U04	Performs dating by visual method and using the programs CDendro and CooRecorder. Assesses the correctness of dating based on statistical indicators. Is able to determine the degree of similarity by using percentage similarity index, correlation coefficients and t- test. Prepares opinions and expertise in the field of dendrochronological dating.	LES2_U04	RL
SOCIAL COMPETENCIES – student is ready to:			
LES_DATDR_K01	Is aware of the need to constantly update his knowledge. Can interact, work and coordinate the performance of tasks in the group.	LES2_K01	RL
LES_DATDR_K02	Is aware of the importance and understands the non-technical aspects and effects of the activities carried out and its impact on the environment and the associated responsibility for decisions. Is able to think and act in an entrepreneurial way.	LES2_K02	RL

Teaching contents

Lectures		12 hours
Topics	<p>General information about the dendrochronology. Dendrochronology in the world and in Poland as a scientific discipline and method. Basic concepts in dendrochronology. Research material and its characteristics. The condition of historical wood and its usefulness in dendrochronological research. Sampling for the construction of incremental patterns from live trees and historical material.</p> <p>Material analysis - tools, instruments, anatomical techniques, transport and storage of samples. Consequences of sampling for trees and wooden objects. Preparation of samples for measuring the tree-ring widths - preparation tools and techniques. Principles of correct making the cross-section of annual rings. Practical ways to strengthen the annual rings. Tree-rings measuring - techniques and devices. Chronologies construction illustrating the variability of tree-ring widths – raw, absolutely dated and standardized chronologies. Wood dating methods. Problems in dendrochronological dating. Factors affecting the accuracy of dating. Sampling methodology for dating wooden objects. Tree-ring analysis and dating in practice. Selected computer programs used in dating. Dating wood in architecture, art, examples of dating in lutherie, painting, architecture as well as administrative and judicial proceedings.</p>	
Accomplished learning outcomes	LES_DATDR_W01; LES_DATDR_W02; LES_DATDR_W03; LES_DATDR_W04; LES_DATDR_K01	
Means of verification, rules and criteria of assessment	Exam passing - the basis of attendance at lectures	
Classes:		15 hours
Topics	<p>Strategies for preparing wood samples for dendrochronological analyzes. Principles of correct making the cross-section of tree-rings. Principles of correct measurement of tree-ring widths using traditional methods and based on digital image analysis. The method of digitizing annual rings. Measurement, transformation and analysis of data using the programs</p>	

	<p>CooRecorder, CDendro. The most common mistakes made during measurements and their verification. Recording of measurement data in the Tucson standard. Transformation of data and creation of individual and site real and normalized chronologies. Dating by visual method and using CDendro and CooRecorder programs. Assessment of correctness of dating based on statistical indicators. Methods for determining the degree of similarity in the tree-rings chronology (percentage similarity and correlation coefficients, t - test). Rules for preparing opinions and expertise in the field of dendrochronological dating.</p>
Accomplished learning outcomes	LES_DATDR_U01; LES_DATDR_U02; LES_DATDR_U02; LES_DATDR_U04; LES_DATDR_K01; LES_DATDR_K02
Means of verification, rules and criteria of assessment	Completing projects (dating of selected objects) for evaluation, evaluation of activity and skills, the share of positive evaluation of passing exercises in the final evaluation is 70%.
Field training:	8 hours
Topics	<p>Proper use of Pressler drill, its sharpening and maintenance. Alternative, non invasive methods of data collection as part of the tree-ring widths analysis of structural and historic wood. Principles of correct choosing of trees for sampling and acquisition of material. Sampling of living trees. Sampling technique of historical wood for dating. Cores preparation and protection. Equipment and devices for preserving collected material. Labelling and securing of material during transport and storage. Preliminary wood preparation for tree-ring widths analysis.</p>
Accomplished learning outcomes	LES_DATDR_U01; LES_DATDR_K01; LES_DATDR_K02
Means of verification, rules and criteria of assessment	Assessment of group activity and skills, the participation of the positive grade from the completion of the exercises in the final evaluation is 10%.

References:

Basic	<p>Schweingruber F.H. (1983). Tree Rings. Basics and Applications of Dendrochronology. Kluwer Academic Publishers, Dordrecht, Holland. Schweingruber F.H. (1993). Trees and Wood in Dendrochronology. Morphological, Anatomical, and Tree-Ring Analytical Characteristics of Trees Frequently Used in Dendrochronology. Springer-Verlag, Berlin Heidelberg, New York, London Paris Tokyo, HongKong Barcelona Budapest. Ważny T., (2001). Dendrochronologia obiektów zabytkowych w Polsce. Muzeum Archeologiczne w Gdańsku, Gdańsk. Zielski A., Krapiec M. (2004). Dendrochronologia. PWN, Warszawa.</p>
Supplementary	<p>Bednarz, Z., 1998. Przykład wykorzystania metod dendrochronologicznych do datowania obiektów sztuki lutniczej. Sylwan 142 (7):89-97. Baillie, M.G.L., 1982. Tree ring dating and archaeology. London, Canberra: Croom Heim. Eckstein, D., Ważny, T., Bauch, J., Klein, P., 1986. New evidence for the dendrochronological dating of Netherlandish paintings. Nature 320:465-466.</p>

Structure of learning outcomes

Area of academic study: R – Agricultural sciences, L - Forestry	3	ECTS
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Structure of student activity

Contact hours	50	hrs.	2	ECTS**
Including:				
lectures	12	hrs.		
classes and seminars	23	hrs.		
consultations	12	hrs.		
participation in research	...	hrs.		
obligatory traineeships		hrs.		
participation in examination	3	hrs.		
e-learning	...	hrs.	ECTS**
student own work	25	hrs.	1	ECTS**

*Areas of academic study in the fields of: H- humanities; S - social studies; P – biological sciences; T – technological sciences; M- medical, sport and health sciences; R – Agricultural, forestry and veterinary sciences; A – the arts

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes