

Module Description

Master of Wood Science



This module description supplements the specific determinations for the Master of Wood Science.

[Stand: 27.11.2019]

Objectives

The English-speaking MSc course of studies in *Wood Science* is a consecutive, research-oriented course, based upon fundamental knowledge of lignocellulose based bioresources and their ranges of application. It deepens the abilities of the students

- to the independent use of expertise, specifically for wood,
- to the independent research according scientific principles and in compliance with scientific methods,
- to the responsible classification of their knowledge in social contexts.

The MSc course of studies in *Wood Science* provides for the students textual, methodical and personal qualifications, which enable them to work in most different occupational fields independently and autonomously to develop approaches by using appropriate methods and tools. The course of studies also imparts a successful development concerning cooperation, delegation and guidance to the students, including sufficient qualifications in structuring and decision-making.

Thereby the graduates are able to take over a management role in economy and research, as well as to develop themselves and the respective field of application.



The MSc course of studies in *Wood Science* also offers graduates of other related BSc course of studies the possibility for deepening and specialization in the area of wood and wood-based products.

Zielsetzung

Der englischsprachige MSc Studiengang Wood Science ist ein konsekutiver, forschungsorientierter Abschluss, aufbauend auf grundlegenden Kenntnissen lignocellulosebasierter Bioressourcen und deren Verwendungsmöglichkeiten. Er vertieft die Fähigkeiten der Studierenden

- zur selbstständigen Anwendung holzspezifischer Fachkenntnisse,
- zur eigenständigen Arbeit nach wissenschaftlichen Grundsätzen unter Einhaltung wissenschaftlicher Methoden,
- zur verantwortungsvollen Einordnung ihres Wissens in gesellschaftliche Zusammenhänge.

Der MSc Studiengang Wood Science vermittelt den Studierenden inhaltliche, methodische und persönliche Qualifikationen, die sie dazu befähigen, in den verschiedensten Berufsfeldern selbstständig und eigenverantwortlich Aufgabenstellungen in größerem Umfang zu bearbeiten und dabei mit geeigneten Methoden Lösungsvorschläge zu entwickeln. Das Masterstudium vermittelt den Studierenden auch eine erfolgreiche Entwicklung hinsichtlich Kooperation, Delegation und Führung mit hinreichenden Strukturierungs- und Entscheidungsqualifikationen. Dadurch sind die Absolventinnen und Absolventen in der Lage in Wirtschaft und Forschung leitende Aufgaben zu übernehmen, sowie sich und das jeweilige Aufgabengebiet weiterzuentwickeln.

Der MSc Studiengang Wood Science bietet auch Absolventinnen und Absolventen anderer fachverwandter BSc Studiengänge die Möglichkeit zur Vertiefung und Spezialisierung in den holzwirtschaftlichen Fachgebieten.

Zentrum Holzwirtschaft, Fachbereich Biologie an der Fakultät für Mathematik, Informatik und Naturwissenschaften der Universität Hamburg vom 20. Juni 2019 (genehmigt am 03. April 2019); gültig ab dem Wintersemester 2019/20.

Beschlossen vom Dekanat der für Mathematik, Informatik und Naturwissenschaften der Universität Hamburg

am 03. April 2019



Master of Wood Science – overview

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WS1	Characteristics and grading of wood						Usage of timber – environmental and economic impacts						Project management						Fibers and fiber based products						Fundamentals of Management					
SS1	Compulsory elective modules																								Elective modules					
WS2																														
SS2	Master thesis																													

Mandatory modules
 Compulsory elective modules
 Elective modules



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Mandatory Modules

1 Characteristics and Grading of Wood

Title	Characteristics and Grading of Wood					
Symbol	MWS01					
Semester	Winter					
Module type	Compulsory module					
Formal requirements for participation	none					
Module coordinator	Prof. Dr. M. Köhl, Phone: +49 4073269 100, E-Mail: Weltforst@uni-hamburg.de; Prof. Dr. A. Krause, +494073962623, andreas.krause@uni-hamburg.de					
Lecturer	Prof. Dr. M. Köhl, Prof. Dr. E. Magel, Prof. Dr. J. Ressel					
Language	English					
Educational objective	Students are familiar with the relationship of wood characteristics and grading (round wood / logs and sawn wood / timber). Moreover, they gain knowledge of common systems of wood grading					
Contents	<p>Round Wood / Logs (MK)</p> <ul style="list-style-type: none"> • Timber scaling: measurement of standing trees, stacked wood and logs, cubic volume, and weight measure • Timber grading by dimension, quality, and utilization • Common European and tropical timber grading rules • Wood sorting procedures -Retail prices of selected timber grades - Sawn Wood / Timber (JR) • Grading of sawn wood for different applications: <ul style="list-style-type: none"> ○ decorative use of timber for furniture, interior applications, flooring, framework by means of visual grading systems ○ load-bearing use / structural use – wall, ceiling, roof etc. – by means of visual and/or mechanical / machine grading systems and non-destructive testing methods, ○ both according to given standards and regulations <p>demonstration of NDT-methods and practical application in the lecture room and lab</p>					
Courses	<ul style="list-style-type: none"> • L: Wood characteristics, grading and implications for use • S: Case studies and excursions on grading of wood • L: Grading of sawn wood • S: Laboratory visual & mechanical grading methods 			1 sem. hrs.	1 sem. hrs.	1 sem. hrs.
Workload (hrs)	L: Wood characteristics ...	ECTS	P (hrs)	S (hrs)	EP (hrs)	
	S: Case studies		14	20	12	
	L: Grading of sawn wood		14	30	12	
	S: Laboratory visual & mechanical grading methods		14	25		
	Total workload	6	180			
Exam framework	Requirements for registration: Active participation in the exercises					



	Type of examination: Oral or written exam (will be announced at the beginning of the course) Language: English
Course type and usability	Compulsory for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.
Duration	one semester
Frequency of occurrence	annual
Literature	Richter, C., 2015: Wood Characteristics: Description, Causes, Prevention, Impact on Use and Technological Adaptation, Springer, Heidelberg Desch, H. E., & Dinwoodie, J. M. (1996). Timber structure, properties, conversion and use (No. Ed. 7). MacMillan Press Ltd..

2 Usage of Timber – Environmental and Economic Impacts

Title	Usage of Timber - Environmental and Economic Impacts				
Symbol	MWS02				
Semester	Winter				
Module type	Compulsory module				
Formal requirements for participation	None				
Module coordinator	Prof. Dr. Michael Köhl, +4973962100, weltforst@uni-hamburg.de				
Lecturer	Prof. Dr. M. Köhl, Prof. Dr. A. Krause, Dr. S. Rüter (TI / HF)				
Language	English				
Educational concept	Students gain basic understanding of the key concepts of the sustainable use of bio resources and the interactions between ecological, economic and social aspects. They get familiar with technology impact assessment aspects.				
Contents	<p><u>Part I Forest Resources</u>: Sustainable forest management and legality; management methods to improve forest growth; environmental impacts of timber production; forest management certification; criteria and indicators for sustainable forest management; local, national and international legal regulations affecting forest management;</p> <p><u>Part II Circular economy and value-chains</u>, calculation methods of material flow, resource efficiency, cascading use and CO2 in material flows (macro approach), political market framework and instruments for circular economy.</p> <p><u>Part III Environmental impact of wood products</u>: Understanding environmental impact of wood products; life cycle assessment (LCA); environmental products declaration (EPD); possibility and limitation of influencing the environmental impact with process optimization and product property optimization.</p>				
Courses	L: Basics about the usage of bio-resources L: Life cycle assessment Pr: Project work on potential impacts			2 sem. hrs. 1 sem. hrs. 1 sem. hrs	
Workload (hrs)		ETCS	P (hrs)	S (hrs)	EP (hrs)
	L: Basics about the usage of bio-resources		28	42	20
	L: Life cycle assessment		14	21	10
	Pr: Project work on pot. impacts		14	21	10
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				



Literature	Will be announced at the beginning of the course
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3 Project Management

Title	Project Management				
Symbol	MWS03				
Semester	Winter				
Module type	Compulsory module				
Formal requirements for participation	none				
Module coordinator	Prof. Dr. A. Krause, +494073962623, andreas.krause@uni-hamburg.de				
Lecturer	all lecturers of the Center for Wood Science				
Language	English				
Educational objective	The students gain skills in project management, planning of processes and productions with respect to ethic and social aspects. They get knowledge on internal management structures and organizational aspects, as well as internal logistics (material flow, internal supply structures etc.). Furthermore the students apply their theoretical knowledge in small projects, such as organizing and managing an excursion, the participation in an exhibition (e.g. LIGNA-fair), a symposium and conference contribution, a special event (e.g. Science Night, <i>Tag der Holzwirtschaft</i>), and a feasibility study.				
Contents	<ul style="list-style-type: none"> • Introduction (project types, project phases and execution, objectives, management, economic viability) • Structure / content of feasibility studies • Project studies - examples from forest product industry • Project implementation (planning of project realization, additional aspects, project follow up and control) • Aspects of business management (selected examples) Exercises and project implementation (e.g. LIGNA fair organization, excursion management, grading field on campus, marketing of wood center, inquiries of actors)				
Courses	L: Theory of project management S: Seminar project exercises E: Excursion			1 sem. hrs. 2 sem. hrs. 1 sem. hrs.	
Workload (hrs)	L: Theory of project management S: Seminar project exercises E: Excursion	ECTS	P (hrs)	S (hrs)	EP (hrs)
			14	24	28
			28	48	
			14	24	
	Total workload	6	180		
Exam framework	Requirements for registration: active participation in excursion (5 to 10 working days) and project planning Type of examination: project report Language: English				
Course type and usability	Compulsory for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	annual				



Literature	<p>Brockhouse, J.W. Jr., Wadsworth, J. J. 2010 - Feasibility study. Vital Steps. A cooperative feasibility study guide. U.S. Department of Agriculture. Rural Business-Cooperative Service. Service Report 58</p> <p>Kuster J, Huber E, Lippmann R, Schmid A, Schneider E, Witschi U, Wüst R 2015 – Project management handbook. Springer Management for Professionals. ISBN 978-3-662-45372-8</p>
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4 Fibers and Fiber based Products

Title	Fibers and Fiber based Products				
Symbol	MWS04				
Semester	Winter				
Module type	Compulsory module				
Formal requirements for participation	none				
Module coordinator	Prof. Dr. B. Saake, Tel.: 040-73962-510, bodo.saake@uni-hamburg.de				
Lecturer	Prof. Dr. A. Krause, Prof. Dr. B. Saake				
Language	English				
Educational objective	Students are familiar with the morphological, chemical and physical characteristics of hardwood, softwood and annual plant fibers derived from different production processes. Moreover, they gain knowledge about the application potential of the fibers for composite products, such as paper, board, fiber board and wood plastic composites.				
Contents	<p>The lecture will first focus on the different production processes and modifications of fibers from various resources. The morphological and chemical differences are discussed for fibers from various natural origins and production processes. The interaction of the different raw materials and production processes will be described, demonstrating as well which process route is advantageous for which raw material. Based on this knowledge the structure property relationship of the different fibers will be discussed for important products from the paper, board, wood product and composite industry. This includes a discussion of bulk products as well as high value products such as special papers, fiber-reinforced composite or nanofibrils. The effect and importance of beating and milling treatments are as well discussed for various product groups.</p> <p>Methods for the characterization of fiber properties and origin by chemical analysis, microscopy, and image analysis are presented.</p>				
Courses	L: Fibers and fiber based products S: Seminar Fibers and fiber based products			3 sem. hrs. 1 sem. hrs.	
Workload (hrs)	L: Fibers & fiber based products S: Seminar Fibers and fiber based products	ECTS	P (hrs) 42	S (hrs) 70	EP (hrs) 30
	Total workload	6	14	24	
			180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One Semester				
Frequency of occurrence	Annual				
Literature	Will be announced at the beginning of the course				

5 Fundamentals of Management (UHH/WISO)

Title	Fundamentals of Management				
Symbol	FUND				
Semester	Winter term				
Module type	Compulsory module				
Formal requirements for participation	none				
Recommended prerequisites	none				
Module coordinator	Prof. Dr. Michael Köhl, +4973962100, weltforst@uni-hamburg.de				
Lecturer	N.N.				
Language	English				
Educational objective	<p>The aim of the module is to make students familiar with management and sustainability issues in an entrepreneurial context. Students should be able to deal with central questions of management theoretically and practically, to work on them independently and to reflect critically. Furthermore, students should be familiar with the challenges and problems of sustainable management in order to enable them to understand the social and economic relationships in detail and to work on and critically reflect on the resulting conflicting objectives of organisations.</p>				
Contents	<p>Within the framework of the module, various compulsory elective events on selected aspects of management are offered. As a rule, the module comprises the following courses, which are offered on a regular basis:</p> <ul style="list-style-type: none"> - Introduction to CSR - International Strategic Management - international organization - Management Accounting and Control - International Market Strategies - finance and investment - Sustainability and Management <p>The range of courses can be supplemented. A selection of courses that can be taken as part of the module will be announced at the beginning of course registration. Students must successfully complete a total of 1 elective courses in the module.</p>				
Courses	L: Selected lecture S: Selected seminar			2 sem. hrs. 1 sem. hrs.	
Workload (hrs)		ECTS	P (hrs)	S (hrs)	EP (hrs)
	L: Selected lecture S: Selected seminar		28 14	72 36	30
	Total workload	6	180		
Exam framework	<p>Requirements for registration: none Type of examination: The courses offered in the module usually end with a written examination of at least 60 minutes. Language: English</p>				
Course type and usability	Compulsory module for M.Sc. Wood Science				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Will be announced at the course beginning				

Elective Compulsory Modules

6 Wood Molecular Biology and Biotechnology

Title	Wood Molecular Biology and Biotechnology				
Symbol	MWS05				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses (BSc level) in wood biology is strictly recommended				
Module coordinator	Prof. Dr. E. Magel, +494073962403, elisabeth.magel@uni-hamburg.de				
Lecturer	Prof. Dr. E. Magel, PD Dr. M. Fladung (TI / Forstgenetik)				
Language	English				
Educational concept	The students achieve a detailed knowledge of the importance of molecular and biotechnological approaches in wood science, such as a tool for proving the legality of wood (wood identification, origin of wood) as well as for producing man-tailored wood (genetic manipulation of trees, somatic embryogenesis).				
Contents	<ul style="list-style-type: none"> The course will focus on different methods for the identification of wood species and the origin of wood (macro-, microscopic, chemical and molecular methods). The strengths, weaknesses and limits of the methods are presented. Biotechnological methods to generate (genetic transformation, somatic embryogenesis,...) produce (tissue culture, sterile culture, ...) and also identify man-tailored transgenic trees and thus wood are presented and discussed. Application of micro and nanotechnologies 				
Educational Concept	L: Wood molecularbiology and biotechnology Pr: Wood molecularbiology and biotechnology			2 sem. hrs. 2 sem. hrs.	
Workload (hrs)		ECTS	P (hrs)	S (hrs)	EP (hrs)
	L: Wood molecularbiology and biotechnology		28	64	10
	Pr: Wood molecularbiology and biotechnology		28	40	10
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Literature being announced at the beginning of the module				

7 Wood Degradation and Protection

Title	Wood Degradation and Protection				
Symbol	MWS06				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses (BSc level) in wood biology is strictly recommended				
Module coordinator	Prof. Dr. J. Fromm, +494073962427, joerg.fromm@uni-hamburg.de				
Lecturer	Prof. Dr. J. Fromm, Prof. Dr. E. Magel				
Language	English				
Educational concept	The students use modern wood biological methods to work on current topics. They achieve profound skills in the field of wood protection and wood damage and degradation.				
Contents	<ul style="list-style-type: none"> • Macroscopic and microscopic methods to detect wood decay • Molecular methods for the identification of wood damaging and destroying organisms (fungi, bacteria) • Quantification of wood decay caused by fungi, bacteria and insects • Investigation of the efficiency of wood impregnating agents and wood modifications • Testing and classification of natural durability of wood • Excursions to various objects of interest 				
Educational Concept	L: Wood degradation and protection Pr: Wood degradation and protection			2 sem. hrs. 2 sem. hrs.	
Workload (hrs)		ECTS	P (hrs)	S (hrs)	EP (hrs)
	L: Wood degradation and protection Pr: Wood degradation and protection		28	64	10
			28	40	10
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Schmidt, O: Wood and tree fungi, Springer (2006) Literature being announced at the beginning of the module				

8 Wood Physiology and Biochemistry

Title	Wood Physiology and Biochemistry				
Symbol	MWS07				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses (BSc level) in wood biology is strictly recommended				
Module coordinator	Prof. Dr. E. Magel, +494073962403, elisabeth.magel@uni-hamburg.de				
Lecturer	Prof. Dr. E. Magel, Prof. Dr. J. Fromm				
Language	English				
Educational concept	The students achieve a deep understanding of wood physiology as well as wood biochemistry with focus on the regulation of the formation of wood and heartwood. They get insights into modern wood biological research methods such as gene expression studies, analyses of metabolites, proteomics and quantitative histochemistry				
Contents	<ul style="list-style-type: none"> Regulation of wood formation by endogenous (phytohormones, carbohydrates, protein, etc.) and exogenous factors (climate, CO₂, soil, water, minerals, anthropogenic conditions, plantation, etc.) Modern methodological approaches to study wood formation (dendroecology, -climatology, biomechanics, biochemistry, molecularbiology, microscopy, cytology, bioassays, mutants and transgenes as model systems) Basic knowledge on wood physiology as well as tree physiology Lap experiments on biochemistry 				
Educational Concept	L: Wood physiology and biochemistry Pr: Wood physiology and biochemistry			2 sem. hrs. 2 sem. hrs.	
Workload (hrs)	L: Wood physiology and biochemistry Pr: Wood physiology and biochemistry	ECTS	P (hrs)	S (hrs)	EP (hrs)
			28	64	10
			28	40	10
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Fromm J, Cellular aspects of wood formation (2014) Rennenberg, H., Eschrich W., Ziegler H. (eds.) Trees - Contribution to modern tree physiology (1997) Literature being announced.				

9 Paper and Board Technology

Title	Paper and Board Technology				
Symbol	MWS08				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses (BSc-level) in wood chemistry and chemical wood technology is strictly recommended				
Module coordinator	Prof. Dr. B. Saake, Tel.: +494073962510, bodo.saake@uni-hamburg.de				
Lecturer	Prof. Dr. B. Saake				
Language	English				
Educational objective	Students have profound knowledge of the different production processes and products of the paper and cardboard industry. They have acquired in depth knowledge of the various paper making technologies for various products like graphic paper, tissue, specialty paper, cardboard and corrugated card board. The importance of waste paper as a fiber source and the different recycling technologies adapted to the various end products will be understood.				
Contents	The lecture will first focus on the different paper production processes. As a basic scenario the production of graphic paper will be presented including strategies for influencing sheet formation and process control by online measurements. Further on the fundamentals of sheet formation and retention will be discussed introducing the most relevant strength additives and retentions aides. Based on these fundamentals the technological specifics of various product groups like tissue paper or specialty grades (e.g. filter paper, security paper, thermopaper) will be presented. The specific needs for production will be one focus explaining the different concepts for the headbox, wire and drying section. The production of card board, corrugated card board and packaging materials will be a further focus of the module. The recycling of waste paper will be presented for the three major end product groups: board, tissue and graphic paper. Analytical techniques for the characterization of paper and paper components and possibilities for process control will be presented.				
Courses	L: Paper and board technology Pr: Development on paper and board production			2 sem. hrs.	2 sem. hrs.
Workload (hrs)	L: Paper and board technology Pr: Development of paper and board production	ECTS	P (hrs) 28 28	S (hrs) 54 40	EP (hrs) 30
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				



Duration	One semester
Frequency of occurrence	Annual
Literature	Will be announced at the beginning of the course

10 Lignocellulose Biorefinery

Title	Lignocellulose Biorefinery				
Symbol	MWS09				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	none				
Module coordinator	Prof. Dr. B. Saake, Tel.: +494073962510, bodo.saake@uni-hamburg.de				
Lecturer	Dr. J. Appelt (TI / HF), Prof. Dr. B. Saake				
Language	English				
Educational objective	Students have in depth knowledge of processes for the conversion of lignocellulosic feedstocks such as wood, straw and bagasse into liquid energy sources and platform chemicals. The knowledge includes thermochemical conversion processes, and technologies based on pretreatment and enzymatic saccharification for the production of fermentable sugars and lignin. The students have acquired also knowledge on economic and environmental aspects of biorefinery processes.				
Contents	In terms of thermochemical conversion processes the generation of oil and other valuable products by pyrolysis, the production of fuel by gasification followed by Fischer-Tropsch synthesis and the implementation of biomass using the hydrothermal carbonisation (HTC) are considered. Another focus is on processes for provision of fermentable sugars and lignin. Here, the steam explosion and organosolv technologies with subsequent enzymatic hydrolysis will be discussed as well as hydrolysis with concentrated mineral acid. The comparison and evaluation of the process of economic and ecological point of view is also part of this lecture. The aspects are deepened in seminar presentations and group work.				
Courses	L: Lignocellulose biorefineries Pr: Lignocellulose biorefineries			3 sem. hrs. 1 sem. hrs.	
Workload (hrs)	L: Lignocellulose biorefineries Pr: Lignocellulose biorefineries	ECTS	P (hrs)	S (hrs)	EP (hrs)
			42	70	30
			14	24	
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Will be announced at the beginning of the course,				

11 Biopolymers

Title	Biopolymers				
Symbol	MWS10				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	None				
Recommended prerequisites	None				
Module coordinator	Prof. Dr. B. Saake, Tel.: +494073962510, bodo.saake@uni-hamburg.de				
Lecturer	Prof. Dr. B. Saake				
Language	English				
Educational objective	Students have in depth knowledge about the processing of wood components into valuable products as polymers or in modified forms. Based on knowledge about the chemical properties of the wood components they will acquire further know how about the processes for the separation and transformation the components into products. A further aspect will be the problems arising from the specificities of the biobased raw materials.				
Contents	The production of dissolving pulps will be discussed as a basis for cellulose derivatives and regenerated fibers. The most important cellulose ethers, esters and regenerated fibers, as well as nanofibrils and aerogels will be presented in terms of their production, properties and application potential. For hemicelluloses and lignins different separation options and their influence on the structure and properties will be highlighted. Selected applications for technical lignins and hemicelluloses will be presented Selected processes and products based on the so called accessory components of lignocellulosics will be presented. Special focus will be laid upon technical problems related to accessory components and their effects on over all characteristics of different species. Analytical methods for the characterization of wood components will be presented.				
Courses	L: Biopolymers from lignocellulosics Pr: Biopolymers from lignocellulosics			3 sem. hrs. 1 sem. hrs.	
Workload (hrs)	L: Biopolymers from lignocellulosics Pr: Biopolymers from lignocellulosics	ECTS	P (hrs)	S (hrs)	EP (hrs)
			42	70	30
			14	24	
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Will be announced at the beginning of the course				

12 Solid Wood Technology

Title	Solid Wood Technology				
Symbol	MWS11				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses (BSc-level) in primary wood processing, mathematics, statistics, economy is strictly recommended				
Module coordinator	Prof. Dr. A. Krause, +494073962623, andreas.krause@uni-hamburg.de				
Lecturer	Prof. Dr. J. Ressel / N.N.				
Language	English				
Educational objective	<p>Students are familiar with secondary wood processing; based on timber as typical sawmill output manifold solid wood products are known. Following an initial timber grading procedure (visual vs. machine grading) the products are still showing typical wood attributes.</p> <p>The students master specific knowledge in wood processing (milling/cutting, routing etc.) and non-cutting processes) of solid wood products (timber drying, laminating, cross laminating ... bending) and structural solid wood components as well as surface treatment methods (staining, oiling, lacquering, powder coating). Also involved are required pre-products and additives, including appropriate timber grading and testing methods (regulations and standards). Complete process chains – starting with timber drying – and processing or operating sequences, plant layouts, alternative production methods and manufacturing costs are included as well.</p>				
Contents	<ul style="list-style-type: none"> • Secondary wood processing (regulations, standards, processing steps, production costs) ... • Timber drying • KVO®, Duo-®, Triolam®, glulam • Cross laminated timber (CLT, XLam, Microllam) • Solid wood components (→ window frames, doors, parquet etc.) • Wood modification (→ heat treatment, wax treatment etc.) • Surface treatment of solid wood products <ul style="list-style-type: none"> • Liquid systems (wood stain, glaze, oil, lacquer) • Solid surface coatings (films, laminates, powder ...) • Quality assurance for surface treatment processes • Ecological assessment of processes and products • Product testing procedures, evaluation of regulations and standards • Excursion to manufacturers of typical solid wood products 				
Courses	L: Solid wood technology Pr: Solid wood technology			2 sem. hrs. 2 sem. hrs.	
Workload (hrs)	L: Solid wood technology Pr: Solid wood technology	ECTS	P (hrs)	S (hrs)	EP (hrs)
			28	44	30
	Total workload	6	180		
Exam framework	Requirements for registration: none				



	Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.
Duration	One semester
Frequency of occurrence	Annual
Literature	<p>Forest Products Laboratory 2010 - Wood handbook—Wood as an engineering material. General Technical Report FPL-GTR-190. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 508 p.</p> <p>Navi, P., Sandberg, D. 2011 - Thermo-Hydro-Mechanical Wood Processing (Engineering Sciences). CRC Press - Taylor & Francis Group. ISBN-13: 978-1-4398-6043-4 (eBook - PDF)</p> <p>Walker, J. C. F. 2006 - Primary Wood Processing: Principles and Practice. Springer, 2nd ed. 2006. ISBN-10: 1402043929, ISBN-13: 978-1402043925</p>

13 Composite Technology

Title	Composite Technology				
Symbol	MWS12				
Semester	Winter or summer				
Module type	Compulsory module				
Formal requirements for participation	none				
Recommended prerequisites	none				
Module coordinator	Prof. Dr. A. Krause, +494073962623, andreas.krause@uni-hamburg.de				
Lecturer	Prof. Dr. A. Krause, Dr. Jan Lüdtkke (TI / HF)				
Language	English				
Educational concept	Students are familiar with basic and advanced principles of composite technology. They have specific knowledge on wood-based composites and natural fiber based composites using various matrix systems.				
Contents	<ul style="list-style-type: none"> • General fiber based composite technology • Duroplastic wood composites • Thermoplastic wood composites • Developing, manufacturing and testing of composites 				
Courses	L: Composite technology			2 sem. hrs.	
	Pr: Composite technology			2 sem. hrs.	
Workload (hrs)		ECTS	P (hrs)	S (hrs)	EP (hrs)
	L: Composite technology		28	21	40
	Pr: Composite technology		28	63	
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Literature being announced at the beginning of the module				

14 Structural Applications of Wood

Title	Structural Applications of Wood				
Symbol	MWS13				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses (BSc-level) in primary wood processing, mathematics, statistics, economy is strictly recommended				
Module coordinator	Prof. Dr. A. Krause, +494073962623, andreas.krause@uni-hamburg.de				
Lecturer	Prof. Dr. J. Ressel, N.N. (HCU)				
Language	English				
Educational objective	Students are familiar with essential aspects of timber construction using solid wood and engineered wood products (EWP). They have comprehensive knowledge on structural timber as well as on EWP for structural use (static / dynamic load, building physics – heat, moisture, sound and fire). Required regulations and standards are discussed. Students gain fundamental skills of timber constructions, thus gaining a deeper understanding on internal relationships between material and structure.				
Contents	<ul style="list-style-type: none"> • Fundamentals of wood construction methods and types (building systems: log construction, stud construction, frame construction, panel / solid timber construction...) • Fundamentals of timber construction of walls, roofs, ceilings, etc.; framework and panel constructions (basic calculations, stability proof, appropriate use of the material in construction and design) • Properties of wood species and EWP used for structural applications including standards, regulations and rules • Heat-, moisture, sound- and fire-protection and related standards (physical fundamentals and basic calculations, performance and typical examples) • Timber utilization in residential housing • Timber engineering • Ecological and economical aspects of structural timber utilization. 				
Courses	L: Structural application of wood Pr: Structural application of wood			2 sem. hrs. 2 sem. hrs.	
Workload (hrs)	L: Structural application of wood Pr: Structural application of wood	ECTS	P (hrs)	S (hrs)	EP (hrs)
			28	52	20
			28	52	
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				



Frequency of occurrence	Annual
Duration	One semester
Literature	<p>Kolb, J. 2008 - Systems in Timber Engineering. Loadbearing Structures and Component Layers. Basel, Boston, Berlin: Birkhaeuser. ISBN: 978-3-7643-8689-4</p> <p>Forest Products Laboratory 2010 - Wood handbook—Wood as an engineering material. General Technical Report FPL-GTR-190. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 508 p.</p>

15 Timber Production

Title	Timber Production				
Symbol	MWS14				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses in timber production (BSc level), mathematics, statistics, economy is strictly recommended				
Module coordinator	Prof. Dr. M. Köhl, +494073962100, weltforst@uni-hamburg.de				
Lecturer	Prof. Dr. M. Köhl, Dr. P. Mundhenk, NN				
Language	English				
Educational concept	Students are familiar with the most fundamental decisions forest managers make in managing forests for timber production.				
Contents	The class covers stand and forest-level decisions. The most fundamental stand-level decision for even-aged stands is deciding when the stand should be harvested. Regeneration and thinning decisions also are important. Uneven-aged management decisions include identifying a target diameter class distribution and selecting a cutting cycle. Forest-level decisions include determining the harvest level, specific areas to be harvested over time, and how much and what areas to allocate to special management areas such as extended rotation areas, aesthetic buffers, stream-side management zones, and wildlife areas. The course emphasises basic tools used in making these decisions, including financial analysis at the stand level and linear programming at the forest level.				
Courses	L: Principles of timber production S: Seminar about decisions for sustainable forest management			2 sem. hrs.	2 sem. hrs.
Workload (hrs)	L: Principles of timber production S: Seminar about decisions for sustainable forest management	ECTS	P (hrs)	S (hrs)	EP (hrs)
			28	40	44
			28	40	
	Total workload	6	180		
Exam framework	Requirements for registration: Active participation and presentation in the seminar Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Kangas,A., Kangas, J., Kurttila, M., 2008: Decision Support for Forest Management, Springer; Nyland, R.D., 2007: Silviculture: Concepts and Applications, Waveland Pr Inc				



	Köhl, M., Magnussen, S., Marchetti, M., 2006: Sampling methods, remote sensing and GIS, Springer
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16 International Forestry and Timber Industries

Title	International Forestry and Timber Industries				
Symbol	MWS15				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses in timber production (BSc level) is strictly recommended				
Module coordinator	Prof. Dr. M. Köhl, +494073962100, weltforst@uni-hamburg.de				
Lecturer	Prof. Dr. M. Köhl, Dr. P. Mundhenk, NN				
Language	English				
Educational concept	Students understand regional characteristics of forestry and timber industries in a global context and are familiar with international policy instruments, initiatives and conventions that have an impact on forestry and timber industries				
Contents	<ul style="list-style-type: none"> • Global forest resources, incl. forest types, site quality, increment, standing volume • Global deforestation and drivers of deforestation • Sustainability and legality, incl. legal frameworks, prevention of illegal logging (FLEGT/VPA); public procurement policy • International initiatives and conventions (e.g. UN-CBD, UN-FCCC, UN-CCD, UNCED, C&I, Bonn Challenge) • Policy instruments (e.g. Coase Theorem, Pigouvian taxes, tradable certificates) • REDD+ - Reducing Emissions from Deforestation and Forest Degradation • Certification (sustainable forest management & CoC) • Timber production, demand and trade • Forest management in the tropics, incl. rehabilitation, reduced impact logging • Forests and climatic change • Land-use conflicts 				
Courses	L: International forestry S: Seminar forest zones (regional focus)			2 sem. hrs. 2 sem. hrs.	
Workload (hrs)	L: International forestry S: Seminar forest zones (regional focus)	ECTS	P (hrs)	S (hrs)	EP (hrs)
			28	30	44
			28	50	
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				



Duration	One semester
Frequency of occurrence	Annual
Literature	Pancel L., Köhl, M., 2016, Tropical Forestry Handbook, Springer

17 Data Sources and Modelling Timber-related Industries

Title	Data Sources and Modelling Timber-related Industries				
Symbol	MWS16				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	Successful completion of courses in timber production (BSc level), basic knowledge of computing in R is strictly recommended				
Module coordinator	Prof. Dr. M. Köhl, +494073962100, weltforst@uni-hamburg.de				
Lecturer	Prof. Dr. M. Köhl, PD Dr. M. Knauf, Dr. Philip Mundhenk, N.N.				
Language	English				
Educational concept	Students are familiar with available national and international data collections/ data sources on wood resources, timber supply and demand, and timber products. They know different approaches for the evaluation of material flows and are able to apply them				
Contents	<ul style="list-style-type: none"> • National and international data sources: access, concepts, nomenclature, and reliability • Basic structures of wood resource balance • Terminology / taxonomy and statistical classification • Evaluation, e.g. lifecycle analysis, material flow analysis, stress and risk analysis, GHG-budgets • Economic ethics • Timber supply and demand modelling • Modelling supply chains und added-value chains 				
Courses	L: Statistical terminology, classification and data sources S: Seminar modelling resource markets			2 sem. hrs. 2 sem. hrs.	
Workload (hrs)	L: Statistical terminology, classification and data sources S: Seminar modelling resource markets	ECTS	P (hrs)	S (hrs)	EP (hrs)
			28	30	44
			28	50	
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Oral or written exam (will be announced at the beginning of course) Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Hamill L., Gilbert, N., Agent-based modelling in economics, Wiley, 2016 https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf				

18 Bioresources and Biorefineries (TUHH)

Title	Bioresources and Biorefineries				
Symbol	M1125				
Semester	Winter				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Recommended prerequisites	none				
Module coordinator	PD Dr. Ina Körner, 040-42878-3154, i.koerner@tuhh.de				
Lecturer	PD Dr. Ina Körner				
Language	English				
Educational objective	Students have a broad understanding of the entire value chain for bio-based products, their environmental, social and economic impact from both, a micro- and macro-level perspective of the bioeconomy and of the interconnectedness and interdependencies of different utilization pathways for biomass.				
Contents	<ul style="list-style-type: none"> • the properties and supply logistics of biological resources • the biotechnological and industrial processes used to convert these resources into (new) bio-based products, and • the marketing and consumption of such products • development of bio-based value chains 				
Educational Concept	L: Biorefinery technology E: Exercise bioresources technology L: Bioresources management E: Exercise bioresources management			2 sem. hrs. 1 sem. hrs. 2 sem. hrs. 1 sem. hrs.	
Workload (hrs)		ECTS	P (hrs)	S (hrs)	EP (hrs)
	L: Biorefinery technology		28	33	30
	E: Exercise bioresources technology		14	-	
	L: Bioresources management		28	33	
	E: Exercise bioresources managmnt.		14	-	
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: written exam. Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	Pandey, A., Höfer, R., Taherzadeh, M., Nampoothiri, M., & Larroche, C. (Eds.). (2015). Industrial biorefineries and white biotechnology. Elsevier. Amsterdam, ISBN 978-0-444-63453-5				

19 Management, Organization and Human Resource Management (TUHH)

Title	Management, Organization and Human Resource Management
Symbol	M0543
Semester	Winter or summer
Module type	Compulsory elective module
Formal requirements for participation	none
Recommended prerequisites	Module “Human Resource Management and Organizational Design” Knowledge of <ul style="list-style-type: none"> • organizations and organizational theories • processes of developing organizational structures for multinational firms • analysis and design of work • strategic management of the human resource function • human resource planning and recruitment in the global environment • managing performance measurement, compensation and benefits of international corporations • employee development; employee separation and retention
Module coordinator	Prof. Dr. M. Köhl, +49 40 73962 100, weltforst@uni-hamburg.de
Lecturer	Prof. Dr. Christian Ringele; Phone: +49 40 42878-4419; E-Mail: c.ringle@tuhh.de
Language	English
Educational objective	The students are able to ... <ul style="list-style-type: none"> • explain organizational designs and strategies in an international environment focused on selected forms of cooperation (e.g., virtual organizations, strategic alliances) to compete in global business; • map the need of organizational changes in light of new business lines, new strategies, altering employee attitudes and internat. competition; • describe the business process management and reengineering techniques in order to consolidate resources to meet internat. customer requirements profitably; • explain the meaning and importance of managing human resources in multinational companies and its relation to organizational designs and strategies; • explain the personnel recruitment and talent management strategies (e.g., personnel planning, employee testing, developing) throughout national and international organizations; • explain the models and approaches for appropriately measuring employee relations (e.g., job satisfaction models) including the development and estimation of causal models; • present the models and research methodologies used to forecast personnel requirements (e.g., forecasting procedures, linear programming, neural networks).
Contents	This course focuses on multinational firms and advanced issues of management, organizations, and human resource management. Selected topics focus, for example, on: Organizational strategy and design in a global environment; International competition and organizational change

	<p>Organizational behavior Competing in a global environment by cooperation (e.g., virtual organizations, strategic alliances) Business process design and business process reengineering International personnel recruitment and placement (e.g., personnel planning, employee testing) Strategic employee compensation of multinational firms and employee relations </p> <p>The seminar deals with...</p> <p>Analyze organizational strategies and structures of global firms Model and analyze business processes of international firms using standard software tools Personnel planning using operations research methodologies Develop and measure causal models for analyzing the satisfaction of employees with different cultural backgrounds Workplace analysis using specific time measurement methods</p>				
Educational Concept	L: Management, organization and human resource management			2 sem. hrs.	
	S: Seminar management, organization and human resource management			2 sem. hrs.	
Workload (hrs)	L: Management, organization and human resource management	ECTS	P (hrs)	S (hrs)	EP (hrs)
	S: Seminar management, organization and human resource management		28	30	44
	Total workload	6	180		
Exam framework	Requirements for registration: none Type of examination: Written exam; Language: English				
Course type and usability	Compulsory elective for MSc of Wood Science, open for students of related MSc programs, dependent on capacities and schedule.				
Duration	One semester				
Frequency of occurrence	Annual				
Literature	<p>Bernardin, H.J.: Human Resource Management: An Experiential Approach, 4e, New York: McGraw-Hill, 2006.</p> <p>Cascio, W.: Managing Human Resources: Productivity, Quality of Work Life, Profits, 6e, New York: McGraw-Hill, 2002.</p> <p>French, W./Bell, C.H./Zawacki, R.A.: Organization Development and Transformation: Managing Effective Change, 5e, Chicago: McGraw-Hill, 1999.</p> <p>Hitt, M.A./Ireland, R.D./Hoskisson, R.E.: Strategic Management: Competitiveness and Globalization, Ohio: Cengage Learning, 2007.</p> <p>Lynch, R.: Strategic Management, 5e, Harlow: Prentice Hall, 2008.</p> <p>Robbins, S.P./Judge, T.A.: Organizational Behavior, 14e, Harlow: Prentice Hall, 2008.</p>				

20 Project Study

Title	Project Study				
Symbol	MWS17				
Semester	Winter or summer				
Module type	Compulsory elective module				
Formal requirements for participation	none				
Module coordinator	Lecturer of the programme				
Lecturer	All lecturers				
Language	English				
Educational concept	Students learn to think and work self-constrainedly in the scientific fields of the Wood Science. They gain experience in designing and carrying out scientific experiments in order to solve scientific problems.				
Contents	Students have to organize their scientific work, write a report and discuss the results of their work				
Courses	Research work: Laboratory work or literature study			
Workload (hrs)		ECTS	S (hrs)	EP (hrs)	total
	Total workload	6	180		
Exam framework	Type of examination: project report Language: English				
Course type and usability	Compulsory elective module				
Frequency of occurrence	Each semester				
Duration	One semester				
Literature	Literature announced at the beginning of the project study				

21 Master's Thesis

Title	Master's Thesis				
Symbol	MWS-AB				
Semester	Summer				
Module type	Compulsory module				
Formal requirements for participation	72 ECTS from compulsory or compulsory elective modules. All compulsory modules have to be successfully passed				
Module coordinator	Lecturer of the programme				
Lecturer	All lecturers				
Language	English				
Educational concept	Students are able to think and work self-constrainedly in the scientific fields of the Master of Wood Science. They have gained experience in presentation and evaluation of their own experimental work in the context of the current scientific state of the art and they are able to solve scientific problems				
Contents	Students have to organize their scientific work, write structured thesis and discuss the results of their work				
Courses	Planning researchwork, writing thesis Preparation of defense		
Workload (h)		ECTS	S (hrs)	EP (hrs)	total
	Total workload	30	900		
Exam framework	Type of examination: written thesis (95%) and oral presentation of thesis (5%) Language: English				
Course type and usability	Compulsory final module				
Frequency of occurrence	Each semester				
Duration	One semester				
Literature	Literature announced at the beginning of the master thesis				