Hochschule München University of Applied Sciences

MODULHANDBUCH

für den Master of Engineering in Paper Technology (konsekutiv - für Ingenieure der Papiertechnik) gültig ab SoSe 2023

Bearbeitungsstand: Dezember 2022

Hochschule München
Fakultät für Technische Systeme, Prozesse und Kommunikation

Lothstrasse 34
80335 München

Inhaltsverzeichnis:

Allgemeine Informationen

Abkürzungen:

ECTS = European Credit Transfer System
SWS = Semesterwochenstunden / Semester hours per week

SU = seminaristischer Unterricht / Lectures
Ü = Übungen / Exercises
Pra = Praktikum / Laboratory experiments

MA = Masterarbeit / Master-Thesis
schrP = Schriftliche Prüfung / Written Examination
mdlP = Mündliche Prüfung / Oral Examination
ModA = Modularbeit / Modular Work

Der seminaristische Unterricht schließt sowohl Wissensvermittlung und als auch das Einüben des Gelernten mit ein. Der Dozent wählt hierbei je nach Themenstellung und organisatorischen/technischen Möglichkeiten die geeignete Methodik und Vorgehensweise.

Hinweise zur schriftlichen Prüfung: Laut ASPO § 21 finden schriftliche Prüfungen (schrP) unter Aufsicht statt und schließen im Master Paper Technology ein Modul ab.

Hinweise zur Modularbeit: Eine Modularbeit (ModA) kann aus einer schriftlichen Ausarbeitung und/oder aus einer Präsentation bestehen. Für Modularbeiten werden Regelungen und Angaben über die Bearbeitungsdauer von Modularbeiten, ihre Ausgabe und ihr Umfang, die Form der Abgabe und die Festlegung des Abgabetermins den Studierenden zu Vorlesungsbeginn von der Prüferin oder dem Prüfer bekanntgegeben.

Überblick über die Module und Prüfungsleistungen

lfd. Nr.	Module	SWS	ECTS	Lehrveran-staltungsart	Prüfungs-form	Zulassungs-voraussetzung	Prüfungs-dauer
B 1	Chemical Engineering	3	4	SU, Ü	schrP		90 - 120 min
B 2	Minerals	4	5	SU, Ü, Pra	schrP	TN	90 - 120 min
B 3	Intercultural Communication	2	3	SU, Ü	mdlP		20 - 40 min
B 4	Scientific Writing	2	3	SU, Ü	ModA		
B 5	Recycled Fibers	4	5	SU, Ü, Pra	schrP	TN	90 - 120 min
B 6	Automation Fundamentals	4	5	SU, Ü	schrP		90 - 120 min
B 7	Fundamentals of Coating	4	5	SU, Ü	schrP		90 - 120 min
B 8	Coating and Barriers	4	5	SU, Ü, Pra	mdlP	TN	20 - 40 min
B 9	General Management	4	5	SU, Ü	ModA		
B 10	Paper Chemistry	4	5	SU, Ü, Pra	schrP		90 - 120 min
B 11	Paper Machine Technology	4	5	SU, Ü, Pra	schrP	TN	90 - 120 min
B 12	Automation and Digitalisation	4	5	SU, Ü, Pra	mdlP		20 - 40 min
B 13	Design of Experiments and Statistics	4	5	SU, Ü	schrP		90 - 120 min
B 14	Circular Economy	4	5	SU, Ü	ModA		
E 1	Specialty Papers	2	2,5	SU, Ü	schrP		90 - 120 min
E 2	Tissue Papers	2	2,5	SU, Ü	ModA		
E 3	Clothing	2	2,5	SU, Ü	mdlP		20 - 40 min
E 4	Data Literacy and Industry 4.0	2	2,5	SU, Ü	ModA		
E 5	Product Development	2	2,5	SU, Ü	ModA		
E 6	Printing Technology	2	2,5	SU, Ü	ModA		
E 7	Project Management	2	2,5	SU, Ü	mdlP		20-40 min
E 8	Patent Law	2	2,5	SU, Ü	schrP		90 - 120 min
E 9	Innovation Management	2	2,5	SU, Ü	ModA		
B 15	Master Thesis		20	MA (0,7) Präs (0,3)			Präs 20 - 40 min

B1 Chemical Engineering

<table>
<tr><td>Module name</td><td colspan="5">Chemical Engineering</td></tr>
<tr><td>Semester</td><td colspan="5">Summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">4</td></tr>
<tr><td>Applicability</td><td colspan="5">General compulsory module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">120h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Prof. Dr. Daniel Eggerath</td><td>Lecture, seminar instruction, project, work, excursion</td><td>3</td><td>45h</td><td>75h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Written examination, 90-120 min</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Daniel Eggerath</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">• Application of mathematical and scientific knowledge to fluid equilibrium, mass flow and mixtures;
• Identification and solution of complex tasks in the field of fluid mechanics and hydraulics;
• Application of mathematical and scientific knowledge to problems in heat transfer in the subject area of conduction, convection and radiation;
• Thorough comprehension of the concepts and laws of thermodynamics;
• Practical application of knowledge in order to analyse and process even difficult problems in thermodynamics;
• Comprehension of possibilities and limitations of thermodynamics in the application;
• Compile independently other principles resulting from the field of thermodynamics and apply the same.
Consequently, the students are enabled to:
• analyse fluid systems,
• compute heat transfer systems for the drier section of a paper machine,
• develop solutions for problems arising from the area of heat transmission and energy consumption,
• solve problems with regard to mass transfers and mass balances.</td></tr>
<tr><td>Teaching content</td><td colspan="5">Mass and Energy Balance, Thermodynamics
• Fundamentals and nomenclature
• Chemical equilibrium and behaviour in phase transformation of fluid properties and their equilibrium
• Mixtures of ideal gases and psychrometric applications
• Energy analysis and energy balances
• Cyclic processes in gas turbines, steam power plants, refrigeration and heat pumps
• Steam systems, heat exchangers and vaporisers</td></tr>
</table>

	• Conduction and convection • Psychrometric diagram • Theoretical Basics of Drying
Prerequisites	Knowledge of physics, mathematics, fundamentals of chemistry and fundamentals of thermodynamics
Literature	Moran, Michael J., Shapiro, Howard N., Fundamentals of Engineering Thermodynamics, SI Version. Hoboken, John Wiley & Sons, 6th ed., 2010
Date	2022-04-04

B2 Minerals

Module name	**Minerals**				
Semester	Winter semester				
Frequency	1 / academic year				
Duration	1 semester				
ECTS	5				
Applicability	General compulsory module for MWP and MKP				
Total Workload	150h				
Teaching courses and student work load	**Lecturer**	**Type**	**SWS**	**Presence studies**	**Self study**
	Prof. Dr. Thoralf Gliese	Lecture, seminar instruction, project work	2	30h	45h
	Anke Lind	Laboratory experiments	2	30h	45h
Type of exam and duration	Written examination, 90-120 min				
Admission requirement for the examination	Laboratory reports				
Responsible for module	Prof. Dr. Thoralf Gliese				
Qualification objectives	• recognize the connection between cause and effect in mineral components; • suggest projects, including complex projects, for the synthesis of mineral materials as well as for the solution of problems encountered with fillers and pigments; • explain the interactions that occur in the course of the processes and, as part of a team, follow the course of the processes – also under changing conditions.				
Teaching content	• Structure, occurrence and preparation of mineral substances, the concepts of mineralogy - with emphasis on carbonates, silicates (clay, talcum), titanium dioxide, sulphates, aluminium compounds, as well as pigments; the use of these as fillers and coating pigments in the paper and packaging materials industries • Behaviour of mineral substances in the first application and in recycling • Consideration of ecological and economic aspects in relation to the products discussed				
Prerequisites	Knowledge of general inorganic chemistry				
Literature	Script Prof. Dr. T. Gliese “Minerals” F. W. Tegethoff (Editor) – “Calciumcarbonat – From the Cretaceous Period into the 21.-st Century” Birkhäuser Verlag – Basel, Boston, Berlin 2001 B.A. Wills – “Minerals Processing Technology”, Intl. Series on Material Science & Technology, Pergamon Press – Oxford / England 1988 R.W. Hagemeyer – “Pigments for Paper”, Tappi Press – Atlanta / GA 1997				
Date	2022-03-17				

B3 Intercultural Communication

<table>
<tr><td>Module name</td><td colspan="5">Intercultural Communication</td></tr>
<tr><td>Semester</td><td colspan="5">Winter semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">3</td></tr>
<tr><td>Applicability</td><td colspan="5">General compulsory module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">90h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Nina Kohr (M.A.)</td><td>Lecture, seminar instruction, case study, excursion</td><td>2</td><td>30h</td><td>60h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Oral examination. 20-40 min</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Helga Zollner-Croll</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">• Knowledge about the common cultural models
• Intercultural sensitisation, become culturally sensitive and aware
• Awareness and perception of own and other cultural concepts
• Competence in communication with others of diverse cultural backgrounds
• Understanding of the interaction between culture and communication, developing an understanding of how individuals perceive and react to cultural rules
• Transfer of this knowledge to the international professional world, contexts</td></tr>
<tr><td>Teaching content</td><td colspan="5">• Theory of intercultural communication
• Theory of culture (e.g. cultural models / dimensions)
• Culture shock
• Theory of communication
• Intercultural competence
• Case studies, critical incidences
• Awareness training
• Simulation of situations of intercultural encounters</td></tr>
<tr><td>Prerequisites</td><td colspan="5">--</td></tr>
<tr><td>Literature</td><td colspan="5">Hall, Edward T.: The Hidden Dimension. Anchor Books, New York, 1969, and 1990
Hiller, Gundula Gwenn: A Matter of Perspective: Critical Incidents from the point of view of Studentenwerke and higher education institutions. Deutsches Studentenwerk, 2016.</td></tr>
</table>

	Hofstede, Geert. Cultures and Organizations - Software of the Mind: Intercultural Cooperation and Its Importance for Survival. Mcgraw-Hill Professional, 2007. Hofstede, Geert; Smith, Douglas M..Exploring Culture: Exercises, Stories and Synthetic Cultures. London, Nicholas Brealey Publishing, 2007. Jandt, Fred E.: *An Introduction to Intercultural Communication*. 7th ed., Sage Publ., 2013. Rothlauf, Juergen: *A Global View on Intercultural Management*. De Gruyter Oldenbourg, 2014 Trompenaars, Fons; Hampden- Turner, Charles. Riding the Waves of Culture. Understanding Cultural Diversity in Business. London, Nicholas Brealey Publishing, 2007.
Date	2022-03-24

B4 Scientific Writing

<table>
<tr><td>Module name</td><td colspan="5">Scientific Writing</td></tr>
<tr><td>Semester</td><td colspan="5">Winter semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">2,5</td></tr>
<tr><td>Applicability</td><td colspan="5">General compulsory module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">90h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Dr. Tobias Kleemann</td><td>Lecture, seminar instruction, written assignments, self-study, exercises (individual and group work), flipped classroom, role-play, video-analysis & feedback</td><td>2</td><td>30h</td><td>60h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Modular work (ModA)</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Dr. Tobias Kleemann</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">• This course module teaches how to write scientific papers and publications.
• This writing ability is vital for success at university or in a professional career. The students explore the conventions of academic writing, consider common mistakes and learn guidelines for structured work. Written texts are individually formulated and improved.
• The students learn the ability to communicate information verbally and visually.
• The students improve their language and presentation skills by practice, reflection and the evaluation of the performance of their peers.</td></tr>
<tr><td>Teaching content</td><td colspan="5">How to plan and write a scientific publication:
• Different types of academic works (articles, overview papers, letters, ...).
• Outline and structure of the work (state-of-the-art, materials and methods, results, discussion, conclusion, summary, bibliography, appendix). What goes where? Which parts may be omitted or collapsed? Where do I start?
• Grammar and tense in scientific writing (presence, imperfect, perfect)
• Active and passive voice in academic works.
• Paragraphs and connecting sentences.
• How to write clearly and plainly, scientifically exact and intelligible.
• Orthography and punctuation.
• Typical terms and expressions that find common use in different parts of an academic publication (to show, demonstrate, illustrate, summarize, conclude, etc.).
• Correct citation, cross-linking and creation of a list of literature / bibliography.</td></tr>
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	• The creation and use of images, tables and diagrams. • Examples of common mistakes in scientific writing. How to communicate and present • Common mistakes of presenters • How to deliver and evaluate a presentation • How to overcome anxiety and stress • How to effectively use your voice and body language. • How to provide constructive feedback • How to handle questions • How to work in groups and teams
Prerequisites	Good command of the English language.
Literature	Scientific Research Writing for non-native English Speakers, ISBN-13: 978-1848163102 Business English ISBN: 9783648121337 , 3648121332 50 Ways to Improve Your Presentation Skills in English, ISBN: 9781902741864, 9783526511908
Date	2022-03-15

B5 Recycled Fibres

Module name	**Recycled Fibres**				
Semester	Summer semester				
Frequency	1 / academic year				
Duration	1 semester				
ECTS	5				
Applicability	General compulsory module for MWP and MKP				
Total Workload	150h				
Teaching courses and student work load	**Lecturer**	**Type**	**SWS**	**Presence studies**	**Self study**
	Prof. Dr. Emanuele Martorana	Lecture, Practical Training / Excursion	2	30h	45h
	Prof. Dr. Emanuele Martorana	Laboratory experiments	2	30h	45h
Type of exam and duration	Written examination, 90-120 min				
Admission requirement for the examination	Laboratory reports				
Responsible for module	Prof. Dr. Emanuele Martorana				
Qualification objectives	• explain, from the process engineering perspective, the processes used in the production of pulp and stock preparation in the paper and board industry with focus on the processes in waste paper recycling; • describe the structure of machinery and procedures used in the paper and board industry; • compute variables relevant to the production of paper and to evolve solutions for engineering problems in a team.				
Teaching content	• Processes used in the preparation of fibre stock suspensions on the basis of primary and secondary fibres. • Criteria for the selection of suitable measures and machinery for the solution of the problem of breakdowns during paper production. • Technical process and machine construction solutions for the production of paper and packaging material. • Criteria and calculations for setting up a pulp-preparation unit for paper and packaging material machines				
Prerequisites	Introduction into Paper Technology, Stock Preparation				
Literature	Papermaking Science and Technology, Volume 7, Recycled Fiber and Deinking, Fapet Oy, Finland, ISBN 952-5216-07-1 Papermaking Science and Technology, Volume 8, Papermaking Part 1: Stock Preparation and Wet End, Fapet Oy, Finland, ISBN 952-5216-10-1 Current publications of the paper technology foundation				
Date	2022-03-15				

B6 Automation Fundamentals

<table>
<tr><td>Module name</td><td colspan="5">Automation Fundamentals</td></tr>
<tr><td>Semester</td><td colspan="5">Summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">5</td></tr>
<tr><td>Applicability</td><td colspan="5">General compulsory module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">150h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Dr. Tobias Kleemann</td><td>Lecture, seminar instruction, excursion</td><td>4</td><td>60h</td><td>90h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Written examination, 90-120 min</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Dr. Tobias Kleemann</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">The student
knows and understands the basic terminology of measurement and control techniques and the fundamental measurement and control elements and concepts, especially
the mode of operation, the application and the use of different sensors
the mode of operation, the application and the use of control elements for linear and non-linear dynamic systems
the structure and the application of programmable storage control and comprehensive hierarchically constructed and decentralized automation system, including their application in process engineering systems
can understand complex problems arising in the field of automation technology and work out concepts or solutions for the corresponding process;
knows the important physical mechanisms in the paper and board production process, the construction and use of sensors and actuators for online measurement, as well as to control the machine-direction profile and the cross-direction profile of those parameters which govern quality;
knows and understands the construction and method of operation of automation systems, especially the quality and process control systems.</td></tr>
<tr><td>Teaching content</td><td colspan="5">Sensors and correcting control elements, measurements and control elements
Modern scanning and non-scanning measurement procedures and systems
Fixed and mobile measurement systems
Modern virtual or soft sensor systems, proxy sensing and sensor fusion
Mesh sensor clusters and wireless mesh networks
Smart sensors and in-situ data pre-processing
Energy harvesting for low-energy sensors
Industry Internet-of-Things (IIoT) and current applications in the industry
Machine direction profile and cross-direction profile control
Web inspection systems
Systems for monitoring machine condition and diagnosis, predictive</td></tr>
</table>

	maintenance • Systems for recognition of breaks in the web and other malfunctions (Event Capturing) • Machine control system layouts and digital user interfaces for operators • Batch and continual processes • Programmable logic control (PLC) • Quality control and process control systems
Prerequisites	Knowledge of mathematics, physics and chemistry
Literature	Schaum's Outline of Feedback and Control Systems, Second Edition, Joseph J. DiStefano, Joseph DiStefano, Allen Stubberud, Ivan Williams, McGraw-Hill Companies,Incorporated, 1995, ISBN 0070170525, 9780070170520 Papermaking Science and Technology, Volume 14, Process and Maintenance Management, Second Edition, Edited by Kauko Leiviskä, Fapet Oy, Finland, ISBN 978-952-5216-34-9
Date	2022-03-15

B7 Fundamentals of Coating

Module name	**Fundamentals of Coating**				
Semester	Summer semester				
Frequency	1 / academic year				
Duration	1 semester				
ECTS	5				
Applicability	General compulsory module for MWP and MKP				
Total Workload	150h				
Teaching courses and student work load	**Lecturer**	**Type**	**SWS**	**Presence studies**	**Self study**
	Prof. Dr. Thoralf Gliese	Lecture, exercises	4	60h	90h
Type of exam and duration	Written examination, 90-120 min				
Responsible for module	Prof. Dr. Thoralf Gliese				
Qualification objectives	• explain the principles of rheology and interfacial physics; • discuss on the basis of the acquired knowledge of rheology and interfacial physics coating of raw paper and the problems of rheology associated with it; • understand on the basis of mathematical principles the effects of the coating process on important parameters of paper and on parameters of printability, their analysis and quality assessment; • discuss the derivation of characteristics encountered in the dynamic, trancient processes, partly under extreme shearing forces; • explain, plan and compute the composition of a coating colour.				
Teaching content	• Rheology, thermodynamics and phenomena of interface physics, in detail • The chemical composition and chemical-physical behaviour of coating pigments • Complex rheological aspects in the application of coating pigments to the surface of paper and packaging material • Methods of application and the machines necessary for these • Influence of surface coating on the aesthetic characteristics, the surface characteristics, and the technical processing parameters				
Prerequisites	Minerals				
Literature	E. Lehtinen – “Pigment Coating and Surface Sizing of Paper” / Papermaking Science and Technology Series Fapet Oy – Finland 2000 T. Metzger – “Das Rheologie-Handbuch für Anwender von Rotations- und Oszillations-Rheometern” Curt R. Vincentz Verlag – Hannover 2000 J.C. Walter – “The Coating Processes” Tappi Press – Atlanta / GA 1993 C.L. Garey – “Physical Chemistry of Pigments in Paper Coating” Tappi Press – Atlanta 1977				
Date	2022-03-17				

B8 Coating and Barriers

Module name	**Coating and Barriers**				
Semester	Summer semester				
Frequency	1 / academic year				
Duration	1 semester				
ECTS	5				
Applicability	General compulsory module for MWP and MKP				
Total Workload	150h				
Teaching courses and student work load	**Lecturer**	**Type**	**SWS**	**Presence studies**	**Self study**
	Prof. Dr. Thoralf Gliese	Lecture, exercises	2	30h	45h
	Anke Lind	Laboratory experiments	2	30h	45h
Type of exam and duration	Oral examination, 20-40 min				
Admission requirement for the examination	Laboratory reports				
Responsible for module	Prof. Dr. Thoralf Gliese				
Qualification objectives	• derive process engineering phenomena of the interface processes and their characteristic magnitudes; • describe the principles and applications of the machines and the course of the processes used for surface application and coating in the paper and packaging material industry, on the basis of laboratory work similar to the industrial process or production on an experimental paper machine; • work out solutions for problems arising during the coating of paper or packaging materials, in a team, and to present these in the form of a report.				
Teaching content	• Calculation and preparation of coating pigments - taking into account theological aspects • Coating/spraying of raw paper and the related problems, on the basis of laboratory equipment. • The effect of the coating process on important characteristics of paper and on printability, and analysis of incidental problems. • Possible processes for coating paper and packaging materials, and their practical implementation in the laboratory and on a technical scale.				
Prerequisites	Fundamentals of Coating				
Literature	E. Lehtinen – “Pigment Coating and Surface Sizing of Paper” / Papermaking Science and Technology Series Fapet Oy – Finland 2000 T. Metzger – “Das Rheologie-Handbuch für Anwender von Rotations- und Oszillations-Rheometern” Curt R. Vincentz Verlag – Hannover 2000 J.C. Walter – “The Coating Processes” Tappi Press – Atlanta / GA 1993				

	C.L. Garey – “Physical Chemistry of Pigments in Paper Coating” Tappi Press – Atlanta 1977
Date	2022-03-17

B9 General Management

<table>
<tr><td>Module name</td><td colspan="5">General Management (Strategic and Accounting)</td></tr>
<tr><td>Semester</td><td colspan="5">Winter Semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">5</td></tr>
<tr><td>Applicability</td><td colspan="5">General compulsory module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">150h</td></tr>
<tr><td rowspan="3">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Prof. Dr. B. Forschelen</td><td>Strategic Management: lecture and seminar activities</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Prof. Dr. P. Sudnik</td><td>Accounting and Finance for Non-Specialists: lecture and seminar activities</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Modular work (ModA)</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Helga Zollner-Croll</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">Strategic Management:

• critically discuss the theoretical and conceptual aspects of strategic management,
• identify the fundamental significance of strategic corporate management for long-term company management,
• recognise strategy-relevant factors and consider these for decision-making
• processes,
• analyse and assess existing strategies and develop new strategic approaches,
• outline the difficulties that can arise in connection with the formulation and implementation of a corporate strategy,
• identify problems associated with practically formulating and implementing strategic company decisions and suggest possible solutions.

Accounting and Finance for Non- Specialists:

• Explain and define the nature and roles of the accounting and finance functions.
• Identify the main users of financial information and discuss their needs.
• Describe the goal of the firm and explain why maximizing the value of the firm is an appropriate goal for a business.
• Explain the key principles that financial managers use when making business decisions.
• Describe the legal forms of business organization.</td></tr>
</table>

	• Describe the nature of the principal–agent relationship between the owners and managers of a corporation, and explain how various corporate governance mechanisms attempt to manage agency problems. • Explain why an understanding of accounting and finance is likely to be relevant to you
Teaching content	**Strategic Management:** • Macro, Industry and Micro environmental analysis • Internal Analysis of Resources and Competences (e.g. VRINO-method) • Strategic management instruments and tools (e.g. portfolio planning models, competitive strategies, Key success factors, competitive advantage, growth or internationalisation strategy, etc) • Strategy formulation, choices, and implementation **Accounting and Finance for Non- Specialists:** In this module, we will designate maximization of shareholder wealth to be the goal of the firm, by which we mean maximization of the total market value of the firm's common stock. There are Five Principles that are the foundations for the study of finance: A. **Principle 1: Cash Flow Is What Matters.** In measuring value, we will use cash flows rather than accounting profits because it is only cash flows that the firm receives and is able to reinvest. In addition, in making business decisions, we will concern ourselves with only what happens as a result of that decision. B. **Principle 2: Money Has a Time Value.** Almost all financial decisions involve comparing money in different periods, perhaps investing today and receiving returns later, or borrowing money today and paying it off later. A Euro received today is worth more than a Euro received in the future because of the time value of money. C. **Principle 3: Risk Requires a Reward.** There is a risk-return trade-off in finance—typical risk-averse investors won't take additional risk unless they expect to be compensated with additional return. Almost all financial decisions involve some sort of risk-return trade-off. D. **Principle 4: Market Prices Are Generally Right.** In general, financial markets are quick to include new information into stock prices and the prices tend to be correct. E. **Principle 5: Conflicts of Interest Cause Agency Problems.** Self-interested managers will not work for the owners' best interest unless it is in the managers' best interest as well. The corporate agency problem is a result of the separation of ownership from the decision makers of the firm. As a result, managers may make decisions that are not in line with the goal of maximization of shareholder wealth. F. **The Essential Elements of Ethics and Trust.** Ethical behavior is doing the right thing, and ethical dilemmas are everywhere in finance. Ethical behavior is important in financial management, just as it is important in everything we do. Businesses cannot interact unless they trust each other. Unfortunately, precisely how we define what is and is not ethical behavior is sometimes difficult. Nevertheless, we should not give up the quest.
Prerequisites	None
Literature	**Strategic management:**

	De Wit, R., Meyer, R. (latest edn) Strategy: Process, Content, Context, London: Thomson Learning Johnson, G., Scholes, K., Whittington, R., (latest edn) Exploring corporate Strategy, Harlow: Pearson Education Ltd. Thompson, A., Strickland, A. (latest edn) Strategic Management, concepts and cases: McGraw-Hill/Irvin **Accounting and Finance for Non- Specialists:** Keown, M.J., Martin, J.D., & Petty, J.W. (2020). Foundations of Finance: The Logic and Practice of Financial Management, 10th Edition, Pearson, London, U.K. Zutter, C.J., & Smart, S.B., (2019). Principles of Managerial Finance: Brief, 8th Edition, Pearson, London, U.K.
Date	2022-03

B10 Paper Chemistry

Module name	**Paper Chemistry**				
Semester	Winter semester				
Frequency	1 / academic year				
Duration	1 semester				
ECTS	5				
Applicability	General compulsory module for MWP and MKP				
Total Workload	150h				
Teaching courses and student work load	**Lecturer**	**Type**	**SWS**	**Presence studies**	**Self study**
	Prof. Dr. Emanuele Martorana	Lecture	4	60h	90h
Type of exam and duration	Written examination, 90-120 min				
Responsible for module	Prof. Dr. Emanuele Martorana				
Qualification objectives	• apply the basic principles of the general, inorganic and organic chemistry, and to explain selected reaction mechanisms of the organic chemistry; • determine the main characteristics of compounds, based on their functional chemical groups; • suggest projects, including complex projects, so as to solve chemical problems which are encountered; • recognize the interactions that occur in the course of the processes and, as part of a team, to follow the course of processes, also under changing circumstances; • explain the use of chemical additives and to test the same in a laboratory scale.				
Teaching content	• Inorganic and organic chemistry, as well as reaction mechanisms • Chemical additives used in the paper und packaging material industries, as well as their use as functional and process chemicals, and mode of action • Interaction of chemical additives in the first application and in recycling • Consideration of ecological and economic aspects in relation to the products discussed • Use of chemical additives in the laboratory, for optimization of the properties of paper and the course of processes in the framework of scientific engineering tasks				
Prerequisites	Knowledge of organic and general inorganic chemistry				
Literature	"Chemical Additives for the production of pulp and paper", Zellcheming Verein, Germany, ISBN 978-3-86641-120-3 (2008) + Skript Prof. Dr. St. Kleemann "Paper Chemistry" Paper Chemistry by J.C.Roberts, Blackie Academie & Professional, ISBN 0 7514 0236 2 (1996)				

	Applications of Wet-end Paper Chemistry by C.O.Au and I.Thorn, Blackie Academie & Professional, ISBN 0 75140034 3 (1995)
Date	2022-03-16

B11 Paper Machine Technology

Module name	**Papier Machine Technology**				
Semester	Winter semester				
Frequency	1 / academic year				
Duration	1 semester				
ECTS	5				
Applicability	General compulsory module for MWP and MKP				
Total Workload	150h				
Teaching courses and student work load	**Lecturer**	**Type**	**SWS**	**Presence studies**	**Self study**
	Prof. Dr. Helga Zollner-Croll	Lecture, seminar instruction, project, work, excursion	2	30h	45h
	Prof. Dr. Helga Zollner-Croll	Laboratory experiments with the Pilot Paper Machine	2	30h	45h
Admission requirement for the examination	Proof of participation of the laboratory experiments				
Type of exam and duration	Written Examination, 90-120 min				
Responsible for module	Prof. Dr. Helga Zollner-Croll				
Qualification objectives	• Compute variables relevant to the production of paper and to evolve solutions for engineering problems in a team; • Explain the processes used in the paper and board industry, including the machinery used in these processes; • Make recommendations for designing the processes and paper grades				
Teaching content	• Principles of technical processes used and important criteria for paper production • Technical processes and possibilities of machine construction for the production of paper and board • Paper production on a technical scale using a pilot paper machine and/or a pilot coater. • Guidance for the preparation and presentation of a student project on the topic of Board and Paper Technology				
Prerequisites	Introduction to Paper Technology, Stock Preparation, Paper Testing				
Literature	Papermaking Science and Technology, Volume 8, Papermaking Part 1: Stock Preparation and Wet End, Fapet Oy, Finland, ISBN 952-5216-10-1 Papermaking Science and Technology, Volume 9, Papermaking Part 2: Drying, Fapet Oy, Finland, ISBN 952-5216-11-1 Papermaking Science and Technology, Volume 9, Papermaking Part 3: Finishing, Fapet Oy, Finland, ISBN 952-5216-12-1 Manual “Betrieb einer Kämmerer Versuchspapiermaschine”				
Date	2022-08-8				

B12 Automation and Digitalisation

<table>
<tr><td>Module name</td><td colspan="5">Automation and Digitalisation</td></tr>
<tr><td>Semester</td><td colspan="5">Winter semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">5</td></tr>
<tr><td>Applicability</td><td colspan="5">General compulsory module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">150h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Dr. Tobias Kleemann</td><td>Lecture, seminar instruction, excursion</td><td>4</td><td>60h</td><td>90h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Oral examination, 20-40 min</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Dr. Tobias Kleemann</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">

This module aims to impart comprehensive knowledge and detailed understanding of subject-specific correlation between mathematics, natural sciences and engineering sciences and the ability to apply the same.
It also imparts a broad-based understanding of examination, analysis, evaluation, optimization and development of complex systems comprised of devices, machines, installations and automation technology in the board and paper industry.
Furthermore, it imparts the ability to communicate with experts in various technical fields in the international professional community and to manage projects on a collaborative and target-oriented basis in a team as a team member and as a team leader and to assume management tasks.

The student

acquires detailed knowledge in the field of

process and production plant automation, with regard to modern control concepts and their application in complex control systems;
data storage and data analysis;
modern concepts of system networking (linking);
bus, communications and Information systems;

is able to

analyze the efficiency of automation systems;
compare and evaluate the applicability of different automation solutions;
find new possible usage for existing automation systems;

knows the procedures to obtain information from large volumes of data for optimal process implementation;
is able to analyze and solve new problems using simulation methods.

</td></tr>
<tr><td>Teaching content</td><td colspan="5">

Feed-forward and feedback control systems
PID Control
Control elements for linear and non-linear systems
Stability criteria for linear and non-linear systems

</td></tr>
</table>

	• Methods and control systems for complex feedback control: ➢ Adaptive feedback control ➢ Multi-variable feedback control ➢ Experts' systems ➢ Fuzzy - logic feedback control ➢ Neuronal networks ➢ Self-Organizing-Maps (SOM) ➢ Decision diagrams Model predictive control (MPC) • System analysis, design and methods used in the latest process control systems • Intelligent field equipment, HART protocol • Fieldbus protocols and network topologies • Visualization and information systems, human-machine interfaces • Communications and management systems • Production planning systems (PPS) • Corporate and management systems (ERP) • The concept of industry 4.0 and its application in the board and paper industry • Modern concepts of cloud based computing and storage • Online and offline simulation and the Digital Twin concept • Digital literacy and data literacy • Big Data, data mining and practical tools for data analysis • Data Science: cleaning, analyzing, and visualizing data • Artificial Intelligence (AI) and Machine Learning (ML) • Concept and current applications of Artificial Neural Networks (ANN) • Extended Reality (XR): current and future applications of augmented (AR), mixed and virtual (VR) reality in the industry
Prerequisites	Knowledge of mathematics, physics and chemistry
Literature	Schaum's Outline of Feedback and Control Systems, Second Edition, Joseph J. DiStefano, Joseph DiStefano, Allen Stubberud, Ivan Williams, McGraw-Hill Companies,Incorporated, 1995, ISBN 0070170525, 9780070170520 Papermaking Science and Technology, Volume 14, Process and Maintenance Management, Second Edition, Edited by Kauko Leiviskä, Fapet Oy, Finland, ISBN 978-952-5216-34-9 Process Control Fundamentals for the Pulp & Paper Industry, Nancy J. Sell, TAPPI Press, ISBN 0-89852-294-3 Pulp and Paper Manufacture, Third Edition, Mill-Wide Process Control & Information Systems, Edited by M. J. Kocurek and D. B. Brewster , published by TAPPI, ISBN 1-895288-44-X
Date	2022-03-15

B13 Design of Experiments and Statistics

<table>
<tr><td>Module name</td><td colspan="5">Design of Experiments and Statistics</td></tr>
<tr><td>Semester</td><td colspan="5">Summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">5</td></tr>
<tr><td>Applicability</td><td colspan="5">General compulsory module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">150h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Prof. Dr. Volker Abel</td><td>Lecture, exercises, seminar instruction, etc.</td><td>4</td><td>60h</td><td>90h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Written examination, 90-120 min</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Emanuele Martorana</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">• select statistical procedures and to apply these confidently;
• draw up a suitable plan of solution for a given technical or scientific problem;
• identify and explain the advantages and disadvantages of such a plan;
• present and evaluate the results of experiments in detail based the statistical point of view.</td></tr>
<tr><td>Teaching content</td><td colspan="5">• the explorative data analysis and statistical intervals
• full and fractional factorial experimental designs
• Response Surface Designs and Mixture Designs
• the contrast coefficient method
• the variance analysis (ANOVA) and the mean value analysis (ANOM)
• the multiple regression
• the Taguchi method</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Knowledge of mathematics and statistics</td></tr>
<tr><td>Literature</td><td colspan="5">Robert L. Mason, Richard F. Gunst, James L. Hess: Statistical Design and Analysis of Experiments with Applications to Engineering and Science, 2nd edition.
Douglas C. Montgomery: Design and Analysis of Experiments, 6th edition.
Peter R. Nelson, Marie Coffin, Karen A.F. Copeland: Introductory Statistics for Engineering Experimentation.</td></tr>
<tr><td>Date</td><td colspan="5">2022-03-02</td></tr>
</table>

B14 Circular Economy

<table>
<tr><td>Module name</td><td colspan="5">Circular Economy and Sustainability</td></tr>
<tr><td>Semester</td><td colspan="5">Summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">5</td></tr>
<tr><td>Applicability</td><td colspan="5">General compulsory module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">150h</td></tr>
<tr><td rowspan="3">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Dr. Wilhelm Demharter</td><td>Sustainable Development</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>N.N.</td><td>Circular Economy</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Modular work (ModA)</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Helga Zollner-Croll</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">Analytical skill to analyse the conception and the assessment of the processes of paper technology, taking into account ethics, ecology and economy, and the sustainability of processes and products.</td></tr>
<tr><td>Teaching content</td><td colspan="5">• Definition of sustainability and sustainable development - General overview
• Ecological basics, material, and life cycles
• Sustainability (sustainability concepts) in relation to energy, water, raw materials, environment,
• Potentials for sustainable development in the paper industry - Focus on sustainability in the paper industry - Environmental reports from the paper industry
• Sustainable forest management
• Environmental Management Systems in the paper industry (ISO 14000, EMAS...)
• Eco-labels in the paper industry: FSC / PEFC, Nordic Swan, Blue Angel, Paper Profiles
• CEPI Roadmap for the Paper Industry
• LCA (life cycle analysis) of paper products</td></tr>
<tr><td>Prerequisites</td><td colspan="5">None</td></tr>
<tr><td>Literature</td><td colspan="5">Papermaking Science and Technology, Volume 2, Forest Resources and Sustainable Managmenet, Second Edition, Edited by Seppo Kellomöki, Fapet Oy, Finland, ISBN 952-5216-02-0
Papermaking Science and Technology, Volume 19, Environmental Control, Second Edition, Edited by Pertti Hynninen, Fapet Oy, Finland, ISBN 952-5216-19-5</td></tr>
<tr><td>Date</td><td colspan="5">2022-08-08</td></tr>
</table>

B15 Master Thesis

Module name	Master Thesis
Semester	Summer Semester or Winter Semester
Frequency	1/study
Duration	6 months
ECTS	20
Work Load	600h
Lecturer	Professors and lecturers for the Master Paper Technology course. The Master Thesis can also be prepared in an organization/company outside the university under the guidance of a responsible faculty member of the University.
Type of exam	Written Master Thesis (70%) and presentation (30%)
Responsible for module	Professors and lecturers for the Master Paper Technology course. The Master Thesis can also be prepared in an organization/company outside the university under the guidance of a responsible faculty member of the University.
Qualification objectives	• The Master Thesis consolidates and tests the students' competence in the methodology pertaining to technical processes and engineering science. • Using scientific methods, the students are able to solve problems in the area of paper technology, working systematically and independently. They extend their scientific knowledge, and are able to present the results of their scientific work - both in writing and orally, as well as to document this in a scientific manner.
Teaching content	• Solving technical/scientific problems, • New and further development of multi-component systems, using experience gained in firms, • Solving complex interdisciplinary problems, taking into account ecological and economic aspects.
Prerequisites	Candidates must achieve the module grade "Fair" or higher in at least 9 of the modules listed in lines 1 – 20 of the supplement to the Study & Examination Regulations.
Literature	Pro The Science of Scientific Writing, George D. Gopen and Judith A. Swan, American Scientist, Nov. 1990, Volume 78, pp. 550-558 The Art of Scientific Writing, H.F.Ebel, C.Bliefert, W.E.Russey, Verlag Wiley-VCH (2004) Scientific Research Writing for non-native English Speakers, ISBN-13: 978-1848163102
Date	2022-09-19

E1 Elective: Specialty Papers

<table>
<tr><td>Module name</td><td colspan="5">Elective: Specialty Papers</td></tr>
<tr><td>Semester</td><td colspan="5">Winter or summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">2,5</td></tr>
<tr><td>Applicability</td><td colspan="5">Elective module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">75h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Prof. Dr. Emanuele Martorana</td><td>Lecture, excursion</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Written examination, 90-120 min</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Emanuele Martorana</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">• The students have detailed knowledge of the manufacturing processes, specific characteristics, and the product requirements for special papers. They know the measurement techniques used, and their limitations.
• The course consolidates the students' competence in the methodology of engineering, using as an example the principles and courses of processes used in the manufacture of various special papers.
• In addition, the students gain extensive knowledge of the market situation, limitations on access to the market, and information about competitors producing various speciality papers. Thus they acquire the ability to solve paper machine relevant difficulties, and problems which arise with the machines during the production of special papers.
• The students are able to use the methods learned to solve complex scientific / technical problems with confidence.</td></tr>
<tr><td>Teaching content</td><td colspan="5">• The different varieties of paper, classification possibilities and market data (consumption vs. production)
• Special fibres as raw materials, and the required processing methods for the production of special varieties.
• Detailed knowledge of the production of self-copying papers, security papers, cast-coated papers and packaging materials, label papers, inkjet papers and various special papers, e.g. décor papers or filter papers.</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Fundamentals of Paper Technology</td></tr>
<tr><td>Literature</td><td colspan="5">Papermaking Science and Technology, Volume 18: "Paper and Board Grades", Fapet OY, Helsinki, 2000
Demonstration material (various Specialty Papers)</td></tr>
<tr><td>Date</td><td colspan="5">2022-03-16</td></tr>
</table>

E2 Elective: Tissue Papers

<table>
<tr><td>Module name</td><td colspan="5">Elective Tissue Paper</td></tr>
<tr><td>Semester</td><td colspan="5">Winter or summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">2,5</td></tr>
<tr><td>Applicability</td><td colspan="5">Elective module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">75</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Prof. Dr. Helga Zollner-Croll</td><td>Seminar-type teaching, experimental demonstrations and laboratory experiments, excursions</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Modular work (ModA)</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Helga Zollner-Croll</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">• Detailed and critical understanding of the state-of-the-art knowledge about the production of tissue paper (specialized know-how);
• Competence with accountability to analyse the conception and evaluation of the tissue production processes while taking into account aspects of ethics, ecology and economy, including sustainability of processes and products;
• Competence to develop and examine products in the paper technology with specific properties and defined quality.</td></tr>
<tr><td>Teaching content</td><td colspan="5">• Requirements of different fibre qualities (cellulose, wood pulp, recovered paper) for tissue products.
• Application of chemical additives for optimization of tissue properties and process cycles in the context of tasks in engineering sciences.
• Production procedures for tissue stock preparation, tissue machine, Yankee Coating.
• Machinery for producing tissue qualities.
• Quality control parameters and investigations
• Market requirements and distribution of tissue products.</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Fundamentals Paper Technology</td></tr>
<tr><td>Literature</td><td colspan="5">Papermaking Science and Technology, Volume 18, Paper and Board Grades, edited by Hannu Paulapuro (2000)</td></tr>
<tr><td>Date</td><td colspan="5">2022-08-08</td></tr>
</table>

E3 Elective: Clothing

Module name	**Elective: Clothing**				
Semester	Winter or summer semester				
Frequency	1 / academic year				
Duration	1 semester				
ECTS	2,5				
Applicability	Elective module for MWP and MKP				
Total Workload	75h				
Teaching courses and student work load	**Lecturer**	**Type**	**SWS**	**Presence studies**	**Self study**
	Pascall Schuivens	Lecture on paper machine clothing, trouble shooting & services.	2	30h	45h
Type of exam and duration	Oral exam, 20-40 min				
Responsible for module	Prof. Dr. Helga Zollner-Croll				
Qualification objectives	This module demonstrates deep insight of raw materials and PMC manufacturing. In addition, deep insight in services, trouble shooting on PMC related issues at end user, the paper maker. The students will have enhanced theoretical knowledge in the field of synthetic raw materials and using them for PMC manufacturing. The will own knowledge on the typical parameters & properties of the raw materials as base for successful PMC design. Appropriate PMC design selection and application as well choosing correct services to solve problems will be part of knowledge transfer.				
Teaching content	• Raw materials used for PMC (forming fabrics, press felts, press sleeves and dryer fabrics) • General construction, manufacturing methods including specific technical properties of the paper machine clothing • Select, analyse, evaluate, monitor and optimize the clothing in the paper machine. • Trouble shooting on a paper machine with direct or indirect relationship to PMC				
Prerequisites	Fundaments of Paper Technology				
Literature	Valmet training material for PMC with partial including material form Voith, Heimbach, Andritz, Runtech, Albany, Oskar Moser, Tappi, Bedea, EMS etc.				
Date	2022-03-07				

E4 Elective: Data Literacy and Industry 4.0

<table>
<tr><td>Module name</td><td colspan="5">Elective Data Literacy and Industry 4.0</td></tr>
<tr><td>Semester</td><td colspan="5">Winter or summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">2,5</td></tr>
<tr><td>Applicability</td><td colspan="5">Elective module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">75h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Dr. Jörg Padberg</td><td>Lecture, seminar instruction, project, work, excursion</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Modular work (ModA)</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Helga Zollner-Croll</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">The students know and understand the (upcoming) challenges of the fourth industrial revolution and the potential opportunities for the paper industry with a focus on data.

In this context, the students gain basic knowledge regarding:
The concept of tidy data
Databases and how to use them
Data visualisation
Data science and what to expect from a data scientist
Big data
Artificial intelligence (i.e. machine learning), including ethical aspects
In order to support the transformation of our industry, the students will face in their professional life, they understand the organisational challenges and gain basic knowledge in change as well as in project management.</td></tr>
<tr><td>Teaching content</td><td colspan="5">Historic industrial revolutions leading to the current fourth industrial revolution.

The pillars of Industry 4.0:
Big data and analytics (in manufacturing)
Autonomous robots
Simulation
Horizontal and vertical integration
Industrial internet of things
Cloud systems
Additive manufacturing
Augmented reality
Cybersecurity
Working with R, the free software environment for statistical computing and graphics, and RStudio, an integrated development environment (IDE) for R.</td></tr>
</table>

Prerequisites	Knowledge in mathematics and statistics Basic working knowledge of Microsoft Excel (or similar) Module Automation Fudamentals
Literature	USTUNDAG, Alp; CEVIKCAN, Emre. *Industry 4.0: managing the digital transformation*. Springer, 2017. SCHWAB, Klaus. *The fourth industrial revolution*. Currency, 2017. VAN DER AALST, Wil. *Process mining: data science in action*. Springer, Berlin, Heidelberg, 2016. MELL, Peter, et al. The NIST definition of cloud computing. 2011. DEHGHANGHADIKOLAEI, Amir, et al. Additive manufacturing methods: a brief overview. *J. Sci. Eng. Res*, 2018, 5. Jg., S. 123-131. VAN DER AALST, Wil MP. Data scientist: The engineer of the future. In: *Enterprise interoperability VI*. Springer, Cham, 2014. S. 13-26.
Date	2022-08-06

E5 Elective: Product Development

<table>
<tr><td>Module name</td><td colspan="5">Elective Product development</td></tr>
<tr><td>Semester</td><td colspan="5">Winter or summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">2,5</td></tr>
<tr><td>Applicability</td><td colspan="5">Elective module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">75h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Dr. techn. Arne Krolle</td><td>Lecture, seminar instruction, exercises</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Modular work (ModA)</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Jürgen Belle</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">• Business model for paper markets
• Innovation Canvas, Value Canvas
• Customer Product description, transfer needs into specification, tolerance
• Technical Capability Analysis; Material Flow
• Time to market definition, risk analysis
• Portfolio alignment</td></tr>
<tr><td>Teaching content</td><td colspan="5">• Efficient product development for volatile markets
• technical definition of paper for converting
• Paper as material for converting
• paper from the point of view of the processor (customer material).
• Theory of product development for new papers</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Fundamentals of paper technology</td></tr>
<tr><td>Literature</td><td colspan="5">Internet research – Alexander Osterwalder Business Canvas</td></tr>
<tr><td>Date</td><td colspan="5">2022-03-29</td></tr>
</table>

E6 Elective: Printing Technology

<table>
<tr><td>Module name</td><td colspan="5">Elective Printing Technology</td></tr>
<tr><td>Semester</td><td colspan="5">Winter or summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">2,5</td></tr>
<tr><td>Applicability</td><td colspan="5">Elective module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">75h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>N.N.</td><td>Seminar-type teaching, experimental demonstrations and lab experiments, excursions</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Modular work (ModA)</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Helga Zollner-Croll</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">The student has the competence,
To explain the process engineering basics of different printing processes and their interaction with the substrate,
To understand the phenomena of adsorption and desorption taking into account the hysteresis behaviour of paper in interaction with printing processes,
To understand the interrelationships between different printing processes and the issues of recycling and to explain problems in the field of printing technology and the interface with the substrate,
to identify common printing processes, to deduce the causes of printing defects and to specify the defect description on the basis of test methods to be found by oneself,
to solve interdisciplinary tasks and optimisations at the interface of printing technology and paper or board independently, to work on problems in a team and to present them,
to communicate with printers in case of complaints</td></tr>
<tr><td>Teaching content</td><td colspan="5">Process engineering principles and technology of the most important printing processes
Climate - adsorption / desorption and hysteresis behaviour
Interphase processes and interaction of materials in the printing process
Analysis of typical printing defects and their correlation to paper properties
Knowledge in the evaluation of printed products
The position of the printer in the event of a complaint</td></tr>
<tr><td>Prerequisites</td><td colspan="5">none</td></tr>
<tr><td>Literature</td><td colspan="5">Kipphan, H.: Handbuch der Printmedien – Technologien und Produktionsverfahren. Springer, Berlin, Heidelberg, New York, 2000
Goldmann G.: Das Druckerbuch – Technik der Océ-Druck-Systeme, Drucktechnologien Océ Printing Systems GmbH, Poing, Ausgabe, 2002
Bruckmann: Leitfaden der Drucktechnik, München Ausgabe 1996</td></tr>
</table>

	PTS Symposien: Wechselwirkungen zwischen Druckfarbe und Papier z.B. Okt 2008
Date	2022-08-08

E7 Elective: Project Management

<table>
<tr><td>Module name</td><td colspan="5">Elective Project Management</td></tr>
<tr><td>Semester</td><td colspan="5">Winter or summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">2,5</td></tr>
<tr><td>Applicability</td><td colspan="5">Elective module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">75h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Prof. Dr. Sven Sängerlaub</td><td>Lecture, seminar instruction, project work, excursion</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Oral examination, 20-40 min</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Emanuele Martorana</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">Project Management:
basics of project management: terms, stakeholders, goals, risks, organisation, communication, work breakdown structure, phases and milestones, scheduling, resources, costs, creativity, negotiations, conflicts, documentation, motivation, leadership
plan, draw up and monitor complex international projects independently;
draw up a project plan that is intricately interlinked with sub-projects;
collaborate as a project manager also with complex international project teams;
monitor, analyse and follow up process sequences using available resources;
solve complicated problems in a team with a result-oriented approach;
present comprehensively multi-layered results together with the team and to evaluate projects.</td></tr>
<tr><td>Teaching content</td><td colspan="5">Project Management:
basics of project management and organisation
collaboration as a project team and role of the int. project manager, preparation of a project plan, implementation of a project, project summary and evaluation
case studies from practical experience
awareness and behaviour training
imparting the basics of group work - exercises (in teams and individually) and presentation of results by the team</td></tr>
<tr><td>Prerequisites</td><td colspan="5">none</td></tr>
<tr><td>Literature</td><td colspan="5">Harvard Business Essentials. Managing Projects Large and Small: The Fundamental Skills for Delivering on Budget and on Time. Boston, Harvard Business School Press, latest ed..</td></tr>
</table>

	Kerzner, Harold. Project Management: A Systems Approach to Planning, Scheduling, and Controlling. New York, John Wiley & Sons, Inc., latest ed.. Martin, Paula; Tate, Karen. Project Management Memory Jogger: A Pocket Guide for Project Teams. Thomas Wuttke, Anton Zandhuis. A pocket companion to PMI's PMBOK® Guide sixth Edition, Based on PMBOK® Guide (English Edition). Van Haren Publishing. 6th ed., 10. April 2019 Verzuh, Eric. The Fast Forward MBA in Project Management. John Wiley & Sons, Inc., latest ed..
Date	2022-03-29

E8 Elective: Patent Law

<table>
<tr><td>Module name</td><td colspan="5">Elective Patent Law</td></tr>
<tr><td>Semester</td><td colspan="5">Summer semester</td></tr>
<tr><td>Frequency</td><td colspan="5">1 / academic year</td></tr>
<tr><td>Duration</td><td colspan="5">1 semester</td></tr>
<tr><td>ECTS</td><td colspan="5">2,5</td></tr>
<tr><td>Applicability</td><td colspan="5">Elective module for MWP and MKP</td></tr>
<tr><td>Total Workload</td><td colspan="5">75h</td></tr>
<tr><td rowspan="2">Teaching courses and student work load</td><td>Lecturer</td><td>Type</td><td>SWS</td><td>Presence studies</td><td>Self study</td></tr>
<tr><td>Dr.-Ing. E.-Ulrich Wittmann</td><td>Lecture, seminar instruction, project work, exercises based on case studies</td><td>2</td><td>30h</td><td>45h</td></tr>
<tr><td>Type of exam and duration</td><td colspan="5">Written examination, 90-120 min</td></tr>
<tr><td>Responsible for module</td><td colspan="5">Prof. Dr. Helga Zollner-Croll</td></tr>
<tr><td>Qualification objectives</td><td colspan="5">• The students develop a thorough interdisciplinary understanding of the possibilities and limits of intellectual property.
• They master the basis of legal protection in commerce, especially in the fields of national and international patent law.
• They are able to analyse the patent rights in relation to technical developments, as well as to analyse a technical/scientific patent specification, on the basis of case studies.
• The students can familiarize themselves with concrete questions concerning patents, registered designs, trademarks, and designs, in the fields of science and engineering, and understand the application of the employee inventions regulations.
• They can assume coordination of the registration of patent rights, between the authorities, patent lawyers, and firms, as well as accompany the development of a firm’s products regarding patent rights.</td></tr>
<tr><td>Teaching content</td><td colspan="5">• Theoretical basis of commercial patent rights and international patent rights (patent law, trademark rights, design patent law, licence rights)
• German and European Patent Law and employee invention regulations
• Work through case studies in the field of registration of patent rights, objections and invalidation suits with the appropriate authorities and law courts
• Preparation for and starting research on patent rights; research strategies and methods</td></tr>
<tr><td>Prerequisites</td><td colspan="5">None</td></tr>
<tr><td>Literature</td><td colspan="5">Patent- und Musterrecht, Beck texte im dtv;
Wettbewerbsecht, Markenrecht, Kartellrecht, Beck texte im dtv;
Arbeitnehmererfindergesetz, Bartenbach, Volz, Heymann-Verlag;
Patentgesetz, Benkhard, C.H. Beck;</td></tr>
</table>

	Gewerbliche Schutzrechte, D. Rebel, Heymann-Verlag; Die europäische Patentanmeldung und der PCT, Gall, Heymanns Verlag; Das neue Markenrecht, Berlit, C.H. Beck
Date	2022-03-18

E9 Elective: Innovation Management

Module name	**Elective Innovation Management**				
Semester	Summer semester or winter semester				
Frequency	1 / academic year				
Duration	1 semester				
ECTS	2,5				
Applicability	Elective module for MWP and MKP				
Total Workload	75h				
Teaching courses and student work load	**Lecturer**	**Type**	**SWS**	**Presence studies**	**Self study**
	Prof. Dr. Klaus Sailer	Seminar-type teaching	2	30h	45h
Type of exam and duration	Modular work (ModA)				
Responsible for module	Prof. Dr. Helga Zollner-Croll				
Qualification objectives	The seminar "Innovation Management" focuses on providing a deeper understanding of dynamic innovation processes and holistic entrepreneurship and developing the necessary know-how, skills, competencies and mindset. To this end, students acquire - theoretical knowledge and practical experience of dynamic, entrepreneurial innovation processes - insights into the influence of the entrepreneur, the team and the external ecosystem on the innovation process - a sense of responsibility for creating a positive impact on society - personal entrepreneurial competencies, perspectives and the required mindset, leadership and management skills, team skills and resilience - methods, tools and models for innovation processes, entrepreneurship, business concepts and creating a start-up - reflection and critical thinking				
Teaching content	- Team-based project work that covers the analysis of the problem and systemic influencing factors, idea generation, prototype creation and validation, and the development of a sustainable business concept that emplies the generation of societal impact. - getting to know one's skills in the areas of innovation and entrepreneurship. - working in a team which involves generating a "shared vision", dynamic role allocation, creating a business concept and reflecting on collaboration - development and implementation of communication concepts and pitches - reflection and feedback				
Prerequisites	Openness and interest in innovation and entrepreneurship, as well as basic knowledge of technologies and technical processes				
Literature	Sarasvathy, S. (2008): Effectuation: Elements of Entrepreneurial Expertise (Cheltenham: Edward Elgar.)				

	Hisrich, R./Peters, M./Shepherd, D. (2013): Entrepreneurship, Mc Graw Hill, New York 2013. Ries, E. (2011): The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business, New York EntreComp: The Entrepreneurship Competence Framework (https://publications.jrc.ec.europa.eu/repository/handle/JRC101581) Sailer, K.; Stark, W.; Leonavicius, E.; Weber, C.; Eder, S.: Real Time Innovation - Change the pattern. Change your thinking.
Date	2022-09-04