



UNIVERSITY
OF APPLIED SCIENCES
MÜNCHEN

MODULE MANUAL

for the Degree Master of Engineering
in Paper Technology
(consecutive)

Effective from WS 13/14

University of Applied Sciences München
Faculty of Chemical Engineering
for Paper and Packaging Materials

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Educational Outcomes of the Study program Master Paper Technology

The Master program “Paper Technology” is based on an intense, technical engineering study concept, focusing on the areas cardboard and paper production. It provides graduates with a profound, wide-ranging specialist and interdisciplinary knowledge about the value chain in the wood, paper and printing industry. The Master program Paper Technology offers an intense subject-specific as well as interdisciplinary training for hands-on engineers that qualifies them for leading positions in the paper industry. Upon successful completion of the program, our graduates are expected to be qualified:

- To manage and optimize entire production processes as well as to plan, set up, put into operation and maintain the corresponding plants.
- To perform in business areas such as application technology consultancy and technical support as well as sales and marketing, thanks to their wide-ranging knowledge of products within the paper industry.
- To hold positions related to research and development of new products, processes and machines, and/or as trouble-shooting experts on technology side.
- To ensure quality standards as well as environmental compatibility and sustainability of production processes and products.
- To further their personal development in order to become executives in the above mentioned areas.

In order to achieve these educational outcomes, our Paper Technology Master program provides students with the following knowledge, skills and expertise:

1. Comprehensive knowledge and understanding of specific mathematical, scientific and academic contexts as well as the capability to apply this knowledge appropriately (i.e. module 1 Chemical Engineering and module 12 Statistics and Design of Experiments);
2. Comprehensive knowledge and understanding of specific technical engineering contexts as well as the capability to apply this knowledge appropriately (i.e. module 2 Paper Chemistry and module 4 Automation I);
3. A broad, detailed and analytical understanding, plus the ability for critical analysis based on their up-to-date level of knowledge in one or more areas of expertise (i.e. module 8 Coating I, module 13 Technical Elective: Clothing and module 14 General Elective: Patent Law);
4. The capability to monitor, analyze, evaluate, improve and develop complex paper industry systems consisting of devices, machines, plants and automation technology applications (i.e. module 5 Automation II and module 7 Board and Paper Technology II);
5. A responsible attitude that enables them to analyze conceptual designs and to evaluate paper technology processes, while taking into account ethical, ecological and economical aspects as well as the sustainability of the processes and products in use (i.e. module 6 Board and Paper Technology I, module 7 Board and Paper Technology II, module 13 Technical Elective: Sustainable Development and module 14 General Elective: Marketing and Product Management);
6. The capability to develop and monitor paper technology products with specific properties and defined quality characteristics (i.e. module 3 Minerals and Printing Technology and module 8 Coating I);
7. The capability to communicate with professionals from various areas of expertise in an international environment and to work on projects cooperatively and in a result-oriented way as part of a team, performing either as a team member or leader (i.e. module 11 Project Management and Intercultural Communication);
8. The capability to present results and papers on a national and international level, to analyze and document processes and results systematically and scientifically, to analyze and challenge existing assumptions regarding their scientific eligibility (i.e. module 10 General Management);

9. The capability of self-organizing learning and work processes according to the concept of lifelong learning, to manage projects, to independently carry out academic work as well as practical research work (i.e. module 9 Coating II and module 15 Master Thesis);
10. A self-reflective way of working and the abilities needed for holding executive positions (i.e. module 3 Minerals, module 7 Board and Paper Technology II and module 11 Project Management and Intercultural Communication).

These educational outcomes include an academic and social competence to carry out a qualified employment. Furthermore, our Master program enables graduates to take on a responsible attitude in civil life and to continuously develop their personality.

MPK 1 Module: Chemical Engineering

Semester	WS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Heinz Ziegler	Lecturers	Prof. Dr. Daniel Eggerath
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, experimental exercises: 60 hours; Preparation and follow-up; Case studies and presentations: 90 hours;		
Recommended prerequisites for participation	Knowledge of Physics, Mathematics, Technical Mechanics		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination(100 %); 180 min		
Method of instruction and learning	Lectures, exercises (individual and group work);		
Language	English		

Objectives of qualification

The transfer of the fundamentals of thermodynamics is intended to enable students to analyze production processes from an energetic point of view. A further insight into the field of fluid dynamics also allows the students to understand and to optimize flow processes.

The students have the following abilities:

- Applying mathematical and scientific knowledge to fluid equilibria, material flows and mixtures;
- Identify and solve complex tasks in the field of flow gauges and hydraulics;
- An in-depth understanding of the concepts and laws of thermodynamics;
- The ability to use their knowledge to analyze and deal with difficult thermodynamic issues in practice;
- Understanding the possibilities and limits of thermodynamics in application examples;
- The ability to independently develop further laws in the field of thermodynamics and to apply them.

The students are then qualified to:

- To analyze liquid systems on their composition,
- to calculate heat transfer systems for the dryer section of a paper machine,
- to develop solutions for problems related to energy consumption,
- Solve questions on material transitions and mass balances.

Course content

- Basics and Nomenclature
- Liquid properties and their equilibrium
- Blends of ideal gases
- Energy analysis and energy balances of systems
- Circulating processes of heat engines
- Steam systems
- Force and mass balance of fluid systems

Module organization

Course of study	Hours to attend	Self- study	Workload	Lecturers
Thermodynamics	30	45	75	Prof. Dr. Daniel Eggerath
Mass and Energy Balance	30	45	75	Prof. Dr. Daniel Eggerath

Reference work

Moran, Michael J., Shapiro, Howard N., Fundamentals of Engineering Thermodynamics, SI Version. Hoboken, John Wiley & Sons, 6th ed., 2010

MPK 2 Module: Paper Chemistry

Semester	WS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Stephan Kleemann	Lecturers	Prof. Dr. Stephan Kleemann
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, experimental exercises: 60 hours; Preparation and follow-up; Case studies and presentations: 90 hours;		
Recommended prerequisites for participation	Knowledge of organic and general inorganic chemistry		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination; 120 min		
Method of instruction and learning	Lectures, exercises (individual and group work); Lab work, presentation		
Language	English		

Objectives of qualification

This module aims to impart subject-specific knowledge and correlation between production processes, including the resulting product properties along the value enhancement chain wood-paper-printing.

It also imparts a broad-based, detailed and critical understanding of the state-of-the-art knowledge in the field of paper chemicals in order to develop and examine products with specific properties and defined quality.

The student is enabled to:

- 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.

Course content

- Inorganic and organic chemistry, as well as reaction mechanisms
- Chemical additives used in the paper and 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

Module organization

Course of study	Hours to attend	Self-study	Workload	Lecturers
Lectures	30	45	75	Prof. Dr. Stephan Kleemann Dr. Roland Pelzer
Lab practical work and on pilot paper machine	30	45	75	Prof. Dr. Stephan Kleemann Sebastian Porkert

Reference works

"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)

MPK 3 Module: Minerals

Semester	WS/SS	Duration	1 semester
Frequency	1/semester	Type	Compulsory course
Person in charge of the module	Prof. Dr. Thoralf Gliese	Lecturer	Prof. Dr. Thoralf Gliese
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 hours; Preparation and follow-up; Case studies: 90 hours;		
Recommended prerequisites for participation	Knowledge of general inorganic chemistry		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination (100 %); 90 min		
Method of instruction and learning	Lectures, exercises (individual and group work), case studies		
Language	English		

Objectives of qualification

This module aims to impart a broad-based, detailed and critical understanding of the state-of-the-art knowledge in the field of coating in order to develop and verify products with specific properties and defined quality.

The students are enabled to understand and explain processes in the field of screening, filtering and classification. They gain detailed knowledge of natural materials, chalk, lime, kaolin, dispersing agents and other additives.

The student is able to:

- 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.

Course 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

Reference works

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

MPK 4 Module: Automation I

Semester	SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Stephan Kleemann	Lecturer	Dr. Tobias Kleemann
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 hours; Time required for preparation and follow-up: 90 hours;		
Recommended prerequisites for participation	Knowledge of mathematics, physics and chemistry		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination; 180 min		
Method of instruction and learning	Lectures, exercises, field trip		
Language	English		

Objectives of qualification

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 overviewing, analysing, evaluating, optimizing and developing complex systems comprising devices, machines, installations and automation technology in the paper industry.

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 data and problems arising in the field of automation technology and work out solutions for the corresponding process;
- knows the important physical mechanisms in the paper 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.

Course content

Consolidation of foundational knowledge of mathematics - vector analysis, special differential equations, Laplace transformation, and transfer functions

- Sensors and correcting control elements, measurement and control elements
- Systems for monitoring machine condition and diagnosis
- Track inspection systems
- Systems for recognition of breaks in the web and other malfunctions (Event Capturing)
- Feed-forward and feedback control systems
- Quality and process control systems

- Machine direction profile and cross-direction profile control
- Batch and continual processes

Reference works

Theory and Problems of Feedback and Control Systems, Second Edition, Joseph J. DiStefano, III, Allen R. Stubberud, Ivan J. Williams, Schaum's Outline Series, McGraw-Hill, ISBN 0-07-017052-5

Papermaking Science and Technology, Volume 14, Process Control, edited by Kauko Leiviskä, Fapet Oy, Finland, ISBN 952-5216-14-4

MPK 5 Module: Automation II

Semester	WS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Stephan Kleemann	Lecturer	Dr. Tobias Kleemann
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 hours; Time required for preparation and follow-up 90 hours;		
Mandatory prerequisites for participation	Automation I Recommended: Knowledge of LabVIEW		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Oral examination; 30 min		
Method of instruction and learning	Lectures, exercises, field trip		
Language	English		

Objectives of qualification

- 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 overviewing, analysing, evaluating, optimizing and developing complex systems comprising devices, machines, installations and automation technology in the paper industry.
- Furthermore, it imparts the ability to communicate with experts in various technical fields in the international professional scenario 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;
 - production planning systems (PPS);
 - corporate and management systems (ERP),
- is able to
 - analyse the efficiency of automation systems;
 - compare and evaluate the efficiency of different automation solution;
 - find new possibilities of use for existing automation systems;
- knows the procedures to obtain data from large volumes of data for optimal process implementation;
- is able to analyse and solve new problems using simulation methods.

Course content

- Modern measurement procedures:
 - Non-Scanning
 - Virtual sensor systems
 - Self-Organising-Maps (SOM)
 - Decision diagrams
- Methods and control systems for complex feedback control-technology:

- Adaptive feedback control
- Multivariable feedback control
- Experts' systems
- Fuzzy - logic feedback control
- Neuronal networks
- System analysis, design and methods used in the latest process control systems:
 - Regulator designs for linear and non-linear systems
 - Stability criteria for linear and non-linear systems
 - Concept for adjustability and monitoring in non-linear systems
 - Process control systems with random input magnitudes
 - Process control systems by means of optimization processes (Performance Index)
- Intelligent field equipment
- Fieldbuses and networks
- System communication
- Visualization- and information systems
- Communications and management systems
- Applications

Reference works

Theory and Problems of Feedback and Control Systems, Second Edition, Joseph J. DiStefano, III, Allen R. Stubberud, Ivan J. Williams, Schaum's Outline Series, McGraw-Hill, ISBN 0-07-017052-5

Papermaking Science and Technology, Volume 14, Process Control, edited by Kauko Leiviskä, Fapet Oy, Finland, ISBN 952-5216-14-4

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 Donald B. Brewster, published by TAPPI, ISBN 1-895288-44-X

MPK 6 Module: Board and Paper Technology I

Semester	SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Helga Zollner-Croll	Lecturer	Prof. Dr. Helga Zollner-Croll
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises, practical work: 60 hours; Time required for preparation and follow-up: 90 hours;		
Prerequisites for participation	Introduction into Paper Technology, Stock Preparation		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination: 120 min		
Method of instruction and learning	Lectures, exercises, practical work, field trip		
Language	English		

Objectives of qualification

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 overviewing, analysing, evaluating, optimizing and developing complex systems comprising devices, machines, installations and automation technology in the paper industry.

Furthermore, it imparts the ability to communicate with experts in various technical fields in the international professional scenario 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 shall have acquired the ability to:

- 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.

Course 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

Module organization

Course of study	Hours to attend	Self-study	Workload	Lecturer
Board and Paper Technology I	30	45	75	Prof. Dr. Zollner-Croll
Practical on stock preparation	30	45	75	Prof. Dr. Zollner-Croll

Reference works

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

MPK 7 Module: Board and Paper Technology II

Semester	WS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Helga Zollner-Croll	Lecturer	Prof. Dr. Helga Zollner-Croll
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 hours; Time required for preparation and follow-up: 90 hours		
Mandatory prerequisites for participation	Introduction to Paper Technology, Stock Preparation, Paper Testing		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Oral examination: 30 min		
Method of instruction and learning	Lectures, exercises, practical work, field trip		
Language	English		

Objectives of qualification

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 overviewing, analysing, evaluating, optimizing and developing complex systems comprising devices, machines, installations and automation technology in the paper industry.

Furthermore, it imparts the ability to communicate with experts in various technical fields in the international professional scenario 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 is able to:

- 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.

On the basis of practical implementation in the laboratory or through production using a pilot paper machine or a pilot coating machine, they demonstrate the ability to implement in a team the acquired engineering knowledge and to present a report on the same.

Course content

- Principles of technical processes used and important criteria for the selection of suitable measures and machinery for the solution of the problem of breakdowns during 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

Module organization

Course of study	Hours to attend	Self-study	Workload	Lecturer
Board and Paper Technology II	30	45	75	Prof. Dr. Zollner-Croll
Practical Paper Machine	30	45	75	Prof. Dr. Zollner-Croll

Reference works

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"

MPK 8 Module: Coating I

Semester	WS/SS	Duration	1 semester
Frequency	1/semester	Type	Compulsory course
Person in charge of the module	Prof. Dr. Thoralf Gliese	Lecturer	Prof. Dr. Thoralf Gliese
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 hours; Time required for preparation and follow-up: 90 hours		
Recommended prerequisites for participation	Minerals		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination: 120 min		
Method of instruction and learning	Lectures with exercises		
Language	English		

Objectives of qualification

This module aims to impart subject-specific knowledge and correlation between production processes, including the resulting product properties along the value enhancement chain wood-paper-printing.

It also imparts a broad-based, detailed and critical understanding of the state-of-the-art knowledge in the field of coating in order to develop and examine products with specific properties and defined quality.

The student acquires the ability to:

- 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, transient processes, partly under extreme shearing forces;
- explain, plan and compute the composition of a coating colour.

Intensive study of the physical phenomena involved enhances competence in the field of natural science methodology.

Course 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

Reference works

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

MPK 9 Module: Coating II

Semester	WS/SS	Duration	1 semester
Frequency	1/semester	Type	Compulsory course
Person in charge of the module	Prof. Dr. Thoralf Gliese	Lecturers	Prof. Dr. Thoralf Gliese/ Dipl.-Ing. Anke Lind
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 hours; Time required for preparation and follow-up: 90 hours		
Mandatory prerequisites for participation	Coating I		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Oral examination: 30 min		
Method of instruction and learning	Lectures, exercises, practical work		
Language	English		

Objectives of qualification

This module aims to impart a broad-based, detailed and critical understanding of the state-of-the-art knowledge in the field of coating in order to develop and examine products with specific properties and defined quality.

It also imparts the ability to communicate with experts in various technical fields in the international professional scenario 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 is able to:

- 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.

The student increases his/her competence in the fields of engineering science and natural science, enabling him/her to do scientific work independently at Master's level.

The acquired knowledge of application in engineering is increased through practical applications and independent abilities.

Course content

- Calculation and preparation of coating pigments - taking into account rheological 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.

Module organization

Course of study	Hours to attend	Self-study	Workload	Lecturers
Coating II	30	45	75	Prof. Dr. Thoralf Gliese
Practical Coating	30	45	75	Anke Lind

Reference works

E. Lehtinen - "Pigment Coating and Surface Sizing of Paper" from the series Papermaking Science and Technology, volume 11, 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

MPK 10 Module: General Management I

Semester	WS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Stephan Kleemann	Lecturer	Dr. Bert Forschelen
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 Std.; Time required for preparation and follow-up: 90 Std.;		
Prerequisites for participation	Basic knowledge of business management		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination; 90 min (50 %) + Study work (50 %)		
Method of instruction and learning	Seminar		
Language	English		

Objectives of qualification

Mediation of the responsible ability to analyze and evaluate the processes of paper technology while respecting the economy and the sustainability of the processes and products;

- Students master the theoretical methods and concepts of management, can assign their relevance to practice, and have the ability to apply these theories independently;
- The deepening of economic competence is tested on real model calculations.

The students are able to:

- understand methods of corporate governance and classify their importance for practice and apply these theories independently,
- calculate and apply financial figures and their interpretation using examples of company reviews and balance sheet analysis,
- link these key figures to the medium and long-term development of the company,
- develop strategic questions from the medium- and long-term perspective and to integrate support for the strategic development process,
- To think in a networked and analytical way, in particular by rapid problem-detection and an independent elaboration of problem solving solutions by methodically applying knowledge from various areas of management.

Course content

- Key figures as measured variables of economic processes and explanation of the control variable function
- Knowledge of the analysis of financial statements and annual reports
- Theory and current research in the field of strategic management - competition strategies, financial planning, market analysis

Reference works

Strategic Management and Business Policy: Concepts and Cases

Thomas L. Wheelen, J. David Hunger Prentice Hall 11th ed. 2007

MPK 11 Module: Project Management and Intercultural Communication

Semester	WS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Heinz Ziegler	Lecturers	Prof. Dr. Heinz Ziegler Annabelle Wolff, M.A.
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 hours; Preparation and follow-up; Compilation of case studies and presentations: 90 hours		
Prerequisites for participation	-		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Oral examination: 30 min		
Method of instruction and learning	Lectures, exercises (individual and group work), case studies (group work), presentations (group work)		
Language	English		

Objectives of qualification

This module aims to impart competence to analyse the concepts and evaluation of processes in the paper technology while taking into account aspects of ethics, ecology and economy, including sustainability of processes and products.

It also imparts the ability to communicate with experts in various technical fields in the international professional scenario and to present the technical results in discussions at national and international levels, 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.

Furthermore, this module aims to impart abilities in self-organization of learning and working processes for lifelong learning, to manage projects, carry out and analyse scientific work and practical research activities systematically and scientifically, and to scrutinize own actions and their scientific viability.

The students are encouraged to achieve multidisciplinary abilities to act and negotiate culturally sensitive in international projects, and to assume leadership responsibilities. The process of awareness is the key to successfully dealing with foreign cultures with which the students are confronted in their future careers. Their intercultural competence is enhanced by the sharpening of their perception of own and foreign perception.

On completion of the course the students are able to:

- plan, draw up and monitor complex international projects independently;
- draw up a project plan that is intricately interlinked 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.

Course content

Introduction to the concept of culture and international project work:

- Cultural dimensions according to G. Hofstede
- Theory of intercultural communication and techniques of communication for project management

- 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
- Business games and simulation of situations of intercultural encounters
- Imparting the basics of group work - exercises (in teams and individually) and presentation of results by the team

Module organization

Course of study	Hours to attend	Self-study	Workload	Lecturers
Project Management	30	45	75	Prof. Dr. Ziegler
Intercultural Communication	30	45	75	Wolff, M.A.

Reference works

Bennet, J.Milton. Basic Concepts of Intercultural Communication. London, Nicholas Brealey Publishing, Intercultural Press 2007.

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..

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.

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.

Trompenaars, Fons; Hampden-Turner, Charles. Riding the Waves of Culture. Understanding Cultural Diversity in Business. London, Nicholas Brealey Publishing, 2007.

Verzuh, Eric. The Fast Forward MBA in Project Management. John Wiley & Sons, Inc., latest ed..

MPK 12 Module: Statistics and Design of Experiments

Semester	SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory course
Person in charge of the module	Prof. Dr. Volker Abel	Lecturer	Prof. Dr. Volker Abel
ECTS Credits	5		
Semester hours/w Student's workload	4 semester hours/w; Lectures, exercises: 60 hours; Time required for preparation and follow-up: 90 hours		
Recommended prerequisites for participation	Knowledge of Mathematics and Statistics		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination: 120 min		
Method of instruction and learning	Lectures, exercises		
Language	English		

Objectives of qualification

This module aims to impart abilities in self-organization of learning and working processes for life-long learning, to manage projects, carry out and analyse scientific work and practical research activities systematically and scientifically, and to scrutinize own actions and their scientific viability.

The students consolidate their competence in mathematics and master the theory and practice of statistical planning and evaluation of experiments.

They are able to use these methods to solve complex scientific and technical problems confidently.

The students are able to:

- 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.

Course content

Unidimensional and multidimensional data, questions related to normal distribution, significant tests and handling questions on statistical intervals.

Working with:

- the explorative data analysis and statistical intervals
- complete factorial and 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

Reference works

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.

MPK 13 Module: Technical Elective: Specialty Papers

Semester	WS/SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory optional course
Person in charge of the module	Prof. Dr. Helga Zollner-Croll	Lecturer	Prof. Dr. Helga Zollner-Croll
ECTS Credits	2.5		
Semester hours/w Student's workload	2 semester hours/w; Lectures, exercises: 30 hours; Time required for preparation and follow-up: 45 hours		
Recommended prerequisites for participation	Introduction into Paper Technology; Paper Testing		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination (100 %): 120 min		
Method of instruction and learning	Lectures, case studies in group work, analyses of demonstration materials, field trip		
Language	English		

Objectives of qualification

This module aims to impart a broad-based, detailed and critical understanding of the state-of-the-art knowledge in the field of speciality papers in order to develop and examine products with specific properties and defined quality.

- 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.

Course content

In this course, the following topics are covered in order to widen the students' knowledge of engineering applications:

- 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.

Reference works

Papermaking Science and Technology, Volume 18: "Paper and Board Grades", Fapet OY, Helsinki, 2000

Viewing material (a variety of specialty papers)

MPK 13 Module: Technical Elective: Clothing

Semester	WS/SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory optional course
Person in charge of the module	Prof. Dr. Stephan Kleemann	Lecturers	Dipl.-Ing. Axel, MBA/ Burmeister
ECTS Credits	2.5		
Semester hours/w Student's workload	2 semester hours/w; Lectures/Group work 30 hours; Time required for preparation and follow-up: 45 hours		
Prerequisites for participation	-		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination (100%): 120 min		
Method of instruction and learning	Lectures, group work: process a case study and present the results		
Language	English		

Objectives of qualification

This module aims to impart a broad-based, detailed and critical understanding of the state-of-the-art knowledge in the field of Paper Machine Clothing in order to develop and examine products with specific properties and defined quality.

The students have enhanced theoretical knowledge in the field of synthesis and processing of polymers. They know the typical properties of plastics and are able to construct and select the paper-machine clothing for the specific application, as well as to use, monitor, and optimize it.

Course content

- Synthesis, chemical structure, physical and chemical properties, including the range of application of plastics.
- General construction, method of manufacture and the technical properties of the wet fabric-sieves, press felts, drying fabric, and belts.
- Methods and calculation procedures for the layout of the 'wire', press and drying sections, taking into account the specific demands of the field of application.
- Analysis, evaluation and optimization of the performance of the clothing in the paper machine.
- Selection and application of the acquired methods and knowledge for the structured solution of specific engineering problems.

Reference works

Script Axel Burmeister, "Paper Machine Clothing"

Adanur, Sabit, Ph.D.; Asten, Inc.: "Paper Machine Clothing", Technomic Publishing CO., INC.(1997), ISBN 1-56676-544-7

Bos, J.H.; Veenstra, P.; Verhoeven, H.; de Vos, P.D.: "Das Papierbuch, Handbuch der Papierherstellung", ECA Pulp & Paper b.v.(1999), ISBN 90-11-06038-5

Michaeli, Walter, Prof.Dr.: "Einführung in die Kunststoffverarbeitung", Carl Hanser Verlag(2006), ISBN-10: 3-446-40580-1

"Papermaking Science and Technology", CD-ROM, Fapet OY (Finnish American Paper Engineers' Textbook), 2000, ISBN 952-5216-22-5

MPK 13 Module: Technical Elective: Tissue Products

Semester	WS/SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory optional course
Person in charge of the module	Prof. Dr. Helga Zollner-Croll	Lecturer	Prof. Dr. Helga Zollner-Croll
ECTS Credits	2.5		
Semester hours/w Student's workload	2 semester hours/w; Lectures, exercises: 30 hours; Preparation and follow-up; Work on exercises, preparation for examination: 45 hours		
Recommended prerequisites for participation	Basic knowledge of fibres, papermaking and paper chemicals		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination: 120 min		
Method of instruction and learning	Lectures, field trip		
Language	English		

Objectives of qualification

This module aims to impart a broad-based, detailed and critical understanding of the state-of-the-art knowledge in the field of tissue in order to develop and examine products with specific properties and defined quality.

The students enhance their knowledge of the manufacturing procedures, specific characteristics and product requirements concerning tissue products. In addition, they acquire insight into the market situation and limitations of market entry, including information about different competitors dealing with a variety of tissue paper.

Following qualifying objectives are achieved:

- broad-based, 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.

Course content

- 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.
- Market requirements and distribution of tissue products.

Reference works

Papermaking Science and Technology, Volume 18, Paper and Board Grades, edited by Hannu Paulapuro (2000)

MPK 13 Module: Technical Elective: Printing Technology

Semester	WS/SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory optional course
Person in charge of the module	Prof. Dr. Heinz Ziegler	Lecturer	Dipl.-Ing. (FH) Heinz Ullrich
ECTS Credits	2.5		
Semester hours/w Student's workload	2 semester hours/w; Lectures/exercises: 30 hours; Time required for preparation and follow-up: 45 hours		
Recommended prerequisites for participation	Basic knowledge of properties of paper		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination (100 %): 120 min		
Method of instruction and learning	Lectures, practical exercises		
Language	English		

Objectives of qualification

This module aims to impart a broad-based, detailed and critical understanding of the state-of-the-art knowledge in the field of Printing Technology in order to develop and examine products with specific properties and defined quality.

It also imparts the competence to communicate with experts fields of study in national and international professional scenario and to discuss problems.

The student acquires the competence to:

- explain the techniques of different printing processes and their interaction with the material to be printed;
- understand the connection between the different printing processes and the question of recycling, and to point out the problems in the field of printing technology in relation to the material to be printed;
- identify current printing processes, to point out the complex causes of faults and to describe the same on the basis of their own testing procedures;
- solve interdisciplinary tasks and find the optimal solutions in relation to the printing method and paper or packaging material being used independently, and to compile and present the problems and possible solutions in a team;
- communicate with printers in the event of complaints;
- weigh the practical constraints in the graphics industry against those in the paper industry.

Course content

- The principles of processing and technology of the most important methods of printing.
- Air conditioning - adsorption / desorption and hysteresis behaviour in the printing process.
- Interface processes and the interaction of materials in the printing process.
- Analysis of typical printing errors and their relationship to the properties of the paper used.
- The know-how to evaluate printing products in case of claims.

Reference works

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

PTS Symposien: Wechselwirkungen zwischen Druckfarbe und Papier z.B. Okt 2008

Fogra: Fehler an Druckerzeugnissen: 1990 erweiterte Ausgabe

MPK 14 Module: General Elective: Marketing and Product Management

Semester	WS/SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory optional course
Person in charge of the module	Prof. Dr. Helga Zollner-Croll	Lecturer	Prof. Dr. Helga Zollner-Croll
ECTS Credits	2.5		
Semester hours/w Student's workload	2 semester hours/w; Lectures, exercises: 30 hours; Time required for preparation and follow-up: 45 hours		
Recommended prerequisites for participation	Basics of varieties of paper and properties of paper		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Preparation and presentation of a Marketing Plan - Teamwork (50%); Case Study/presentation - individual work (50%)		
Method of instruction and learning	Lectures; Case Studies, including presentations; preparation of a Marketing Plan; possible cooperation with an industrial partner - (Specialty) paper production; presentation of concepts developed;		
Language	English		

Objectives of qualification

This module aims to impart the ability to communicate with experts in various technical fields in the international professional scenario and to present the technical results in discussions at national and international levels, 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 students have complete grasp of:

- marketing and product management with the example of paper products and of the paper products market;
- the possibilities of successfully developing marketing concepts and master the result analyses and controlling methods.

The aspects of marketing are jointly worked out and discussed in detail on the basis of case studies and marketing plans.

By presenting the drafted marketing plan to an industrial partner, the students are able to analyse and document the results and introduced to a technical audience.

Course content

Introduction to Marketing Mix, particularly to the possibilities of successfully using the Marketing Mix instruments

- Targets (quantitative and qualitative aims, timeframe, etc.)
- SWOT analyses of the products
- Customer (purchasing) behaviour
- Distribution channels of the paper industry in Europe and possible distribution strategies
- Market research on potential competitors
- Market segmentation (with focus on product properties, customer, distribution)
- Budgeting of costs
- Planning of market introduction of a special product (target group oriented print advertising, Internet presence, Event Management, trade fair participation, customer retention schemes)
- Controlling mechanisms, success analyses

Reference works

Marketing - Concepts and Strategies, William M. Pride, O. C. Ferrell, Houghton Mifflin Company
Marketing Management - Analysis, Planning, Implementation and Control, Philip Kotler, Prentice Hall

MPK 14 Module: General Elective: Patent Law and Intellectual Property

Semester	WS/SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory optional course
Person in charge of the module	Prof. Dr. Stephan Kleemann	Lecturer	Dr.-Ing. E.-Ulrich Wittmann
ECTS Credits	2.5		
Semester hours/w Student's workload	2 semester hours/w; Lectures, exercises: 30 hours; Time required for preparation and follow-up: 45 hours		
Prerequisites for participation	-		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination (100 %): 90 min		
Method of instruction and learning	Lectures, exercises based on case studies		
Language	English		

Objectives of qualification

This module aims to impart a detailed and critical understanding of the state-of-the-art knowledge in the field of Patent Law and Intellectual Property Rights.

- 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 with regard to patent rights.

Course content

- 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

Reference works

Patent- und Musterrecht, Beck texte im dtv;
Wettbewerbsecht, Markenrecht, Kartellrecht, Beck texte im dtv;
Arbeitnehmererfindergesetz, Bartenbach, Volz, Heymann-Verlag;
Patentgesetz, Benkhard, C.H. Beck;
Gewerbliche Schutzrechte, D. Rebel, Heymann-Verlag;
Die euro. Patentanmeldung und der PCT, Gall, Heymanns Verlag;
Das neue Markenrecht, Berlitz, C.H. Beck

MPK 14 Module: General Elective: General Management II

Semester	SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory optional course
Person in charge of the module	Prof. Dr. Stephan Kleemann	Lecturer	Prof. Dr. Paul Sudnik / Prof. Dr. Klaus Sailer
ECTS Credits	2.5		
Semester hours/w Student's workload	2 semester hours/w; Lectures, exercises: 30 hours; Time required for preparation and follow-up: 45 hours		
Prerequisites for participation	Knowledge of Mathematics		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written examination (100 %): 90 min		
Method of instruction and learning	Lectures, exercises (individual and group work)		
Language	English		

Objectives of qualification

Financial accounting:

Mediation of the responsible ability to analyze and assess the processes of paper technology while respecting the economy and the sustainability of the processes and products

The student is empowered,

- to work with complex information from the area of company assessment and balance analysis, using mathematical, statistical methods,
- understand and to apply the current theories of the investment and finance account, including the instruments used,
- to carry out a static and dynamic investment planning with regard to security and uncertainty on the basis of specific problems and to explain their interdepartmental significance.

Innovation Management:

- Mediation of different innovation management approaches with the focus on dynamic, complex innovation processes, which focus on the combination of personality (for example, creativity, leadership, handling uncertainty, management skills), team constellation and managing the different phases of the innovation process.
- Understanding of the interrelationships between leadership, management and innovation and entrepreneurship
- Development of personal strengths, learning fields, values, characteristics, visions
- Apply the different phases of an innovation process and develop the necessary personal skills
- Mediation of leadership and management skills
- Work in an interdisciplinary team
- Placement of practical experience by working on a real project

Course content

Financial accounting:

- Theory and practice of investment and financing calculations
- Financial ratios and their interpretation using examples of company reviews and balance sheet analysis
- Analysis of balance sheets and annual reports

- Investment and financing calculation to take account of decision uncertainty

Innovation Management:

- Theory and practice of different innovation models and their phases
- Development of a business model and of a business plan
- Formulation of implicit customer requirements
- Creativity techniques
- Working in a team

Module organization

Course of study	Hours to attend	Self-study	Workload	Lecturers
Financial accounting	30	45	75	Prof. Dr. Paul Sudnik
Innovation Management	30	45	75	Prof. Klaus Sailer

Reference work

Brealey/Myers/Markus: Fundamentals of Corporate Finance Mc Graw Hill 4th Ed.

MPK 14 Module: General Elective: Sustainable Development

Semester	WS/SS	Duration	1 semester
Frequency	1/academic year	Type	Compulsory optional course
Person in charge of the module	Prof. Dr. Helga Zollner-Croll	Lecturer	Prof. Dr. Helga Zollner-Croll
ECTS Credits	2.5		
Semester hours/w Student's workload	2 semester hours/w; Lectures, exercises: 30 hours; Preparation and follow-up; Work on exercises, preparation for examination: 45 hours		
Recommended prerequisites for participation	-		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Oral examination: 30 min		
Method of instruction and learning	Lectures, exercises (individual and group work), field trip, case studies, presentations		
Language	English		

Objectives of qualification

This module aims to impart abilities with accountability in the analysis of the conception and evaluation of the processes in the paper technology, while taking into account the aspects of ethics, ecology and economy, including the sustainability of the processes and products.

The students are able to:

- analyse products and processes in the paper technology and to evaluate their compatibility with the environment;
- develop products and processes for the paper technology that will be in harmony with the requirements of environmental compatibility.

Course content

- Definition of sustainability and sustainable development - a general overview
- Ecological principles, material and life cycles
- Concepts of sustainability with reference to energy, water, raw materials, environment, nature
- Scope for sustainable development in paper industry - focus on sustainability in the paper industry - environmental reports from the paper industry
- Sustainable forest management (the example of Lübeck city's forest)
- Environmental Management Systems in the paper industry (ISO 14000, EMAS...)
- Eco-label in the paper industry: FSC / PEFC, Nordic Swan, Blauer Engel, Paper Profiles,
- CEPI Roadmap for the paper industry - What does this mean to the paper industry?

Reference works

Different reports on sustainability from the fields of machine construction, chemical industry, paper industry, printing industry; CEPI Roadmap

MPK 15 Module: Master Thesis

Semester	SS	Duration	6 months
Frequency	1/study	Type	Compulsory module
Person in charge of the module	Professors in-charge of the Master Paper Technology course		
Lecturer(s)	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.		
ECTS Credits	20		
Semester hours/w Student's workload	600 hours		
Mandatory prerequisites for participation	Candidates must achieve the module grade "Fair" or higher in at least 9 of the modules listed in lines 1 - 14 of the supplement to the Study & Examination Regulations.		
Other application	Master Paper Technology (further education)		
Type of examination and duration	Written Master Thesis and oral colloquium (30 min)		
Method of instruction and learning	Guided independent science project		
Language	English		

Objectives of qualification

This module aims to impart abilities in self-organization of learning and working processes for life-long learning, to manage projects, carry out and analyse scientific work and practical research activities systematically and scientifically, and to scrutinize own actions and their scientific viability.

- 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.

Course content

The tasks are set as part of a research project or relate closely to an application, at a scientific level.

Topics for the Master Thesis may, for example, be in the following fields:

- 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.

Reference works

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)