



UNIVERSITY  
OF APPLIED SCIENCES  
MÜNCHEN

## MODULE MANUAL

for the Degree Master of Engineering  
in Paper Technology  
(Further Education)

April 2009

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

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# MPW 1 Module: Thermodynamics and Chemical Engineering

Course	Thermodynamics
Semester	1
Credits	2,5
Workload	Seminar type course: 24 hrs; Time spent on preparation and evaluation of class work, working on exercises: 51 hrs;
Person Responsible for Module	Prof. Dr. Heinz Ziegler
Method of Instruction	Lectures, Exercises (individual and group work)
Language	English
Media Used	Beamer presentation, Overhead projector, f

## Lecturer

Prof. Dr. Heinz Ziegler

## Prerequisites

Knowledge of physics, mathematics, chemistry and thermodynamics

## Learning aims

The students

- have a deeper understanding of the concepts and laws of thermodynamics,
- have the ability to apply mathematical models and physical laws,
- are able to apply complex theoretical knowledge in order to analyse and solve difficult problems in practice,
- have the necessary deep knowledge to recognize the possibilities and limits in application.

## Contents

- Ideal gas mixtures and psychrometrics
- Exergy analysis
- Cyclic processes of gas turbines, vapour power systems; refrigeration and heat pump systems
- Chemical and phase equilibrium
- Exercises and solution of problems

## Literature

Moran, Michael J., Shapiro, Howard N., Fundamentals of Engineering Thermodynamics, SI Version. Chichester, John Wiley & Sons, 5th ed.

Bird, Stewart, Lightfoot. Transport Phenomena, John Wiley. New York

Stephan, Mayinger. Thermodynamik Band 2, 12. te Auflage, Springer, Berlin

## Proof of Proficiency

Written examination (50 %)

# MPW 1 Module: Thermodynamics and Chemical Engineering

Course	Chemical Engineering
Semester	1
Credits	2,5
Workload	Seminar type course: 24 hrs; Time spent on preparation and evaluation of class work, working on exercises: 51 hrs;
Person Responsible for Module	Prof. Dr. Stephan Kleemann
Method of Instruction	Lectures; Exercises (individual and group work)
Language	English
Media Used	Beamer presentation, Overhead projector, Blackboard

## Lecturer

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## Prerequisites

Knowledge of physics, mathematics, chemistry and thermodynamics

## Learning aims

- The students are able to derive and solve steady-state and transient material balance reactions.
- They can calculate balance constants of reactions, work with the characteristic magnitude for the technical processes and have a detailed knowledge how to convert data from the laboratory to the production scale.
- They have mastered the thermodynamics of interface phenomena and know in detail the two-phase combinations of interface surfaces and their physical-chemical properties.
- They have detailed knowledge about the use and applications of the interface phenomena in technical processes.

## Contents

- Balance equations for mass, energy and Impulses taking all the relevant physical and chemical phenomena into account
- Principles and significance of the kinetics of chemical reactions
- The specific characteristic magnitudes of heat transfer and mass transport
- The interaction of chemical reactions and transport of material, as well as behaviour during the 'resting periods
- The principles and details of the thermodynamics of interface phenomena and their application
- Scale-up calculations

## Literature

Richard M. Felder and Ronald W. Rousseau, *Elementary Principles of Chemical Processes*, Third Edition, Wiley (1999).

F. S. Fogler, *Elements of Chemical Reaction Engineering*, 3rd Ed. (1999).

James O. Wilkes, *Fluid Mechanics for Chemical Engineers*, Prentice Hall PTR, 1999

Stokes, Robert und Evans, D. Fenell, *Fundamentals of Interfacial Engineering*, Wiley-VCH. Dörfler, Hans-Dieter, *Grenzflächen- und Kolloidchemie*, Wiley-VCH

## Proof of Proficiency

Written examination (50 %)

## MPW 2

### Module: Introduction to Paper Technology

<b>Course</b>	
Semester	1
Credits	5
Workload	Lectures, exercises, practical work and field trip: 48 hrs. Preparation and evaluation time: 102 hrs.
Person Responsible for Module	Prof. Dr. Stephan Kleemann
Method of Instruction	Lectures; Exercises; Practical work; Field trip
Language	English
Media Used	Beamer presentation, Overhead projector, Blackboard, Samples

#### Lecturers

Dr. Bernhard Wirth + Dipl.-Ing. (FH) Jürgen Belle

#### Prerequisites

None

#### Learning aims

The students are able to

- familiarize themselves with specific natural-science and detailed technical processing matters,
- explain principles of natural science, measurement and machine technology, as used in paper production processes,
- explain the structure and function of packaging, as well as the processing and upgrading procedures for paper and synthetic materials,
- work independently on laboratory procedures and measuring equipment currently used in the paper industry,
- compile and evaluate measured parameters meaningfully, and to interpret these in depth on the basis of engineering technology,
- explain the obtained data through model concepts learned in the theoretical work and to develop ideas which will enable optimization of the complex processes in paper production.

#### Contents

- Morphology and chemical structure of wood and important fibres used in papermaking
- Raw materials and technical processes used in the preparation of pulp
- Technology of pulp preparation and paper production
- Engineering science applications for equipment used in papermaking
- Technical procedures used in methods of processing and upgrading
- Experimental work in the laboratory for paper technology, using various stock suspensions.
- Independent use of analytical measurement systems in the chemical laboratory. Analysis and discussion of the data obtained, on the basis of one's own reports on these.

## Literature

G.A. Smook, Handbook For Pulp & Paper Technologists, 2nd Edition, Angus Wilde Publications, ISBN 0-9694628-1-6

Hannu Paulapuro, Paper and Board Grades, Fapet Oy, ISBN 952-5216-18-7

Herbert Holik (Ed.), Handbook of Paper and Board, Wiley-VCH Verlag GmbH & Co. KGaA, ISBN 3-527-30997-7

Johan Gullichsen, Carl-Johan Fogelholm, Papermaking Science and Technology, Chemical Pulping

Johan Gullichsen, Hannu Paulapuro, Papermaking Science and Technology, Mechanical Pulping

## Proof of Proficiency

Written Examination (70%) + Oral examination (30%)

## MPW 3 Module: Pulp Technology

<b>Course</b>	
Semester	1
Credits	5
Workload	Lectures, exercises: 24 hrs. Preparation and evaluation time: 51 hrs. Student project: 75 hrs.
Person Responsible for Module	Dr. Helga Zollner-Croll
Method of Instruction	Lectures; Case studies; Discussions in groups; Exercises; Presentation of case studies by the students
Language	English
Media Used	Laptop, Beamer presentation, Overhead projector, Blackboard, Demonstration material

### Lecturer

Dr. Helga Zollner-Croll

### Prerequisites

Knowledge of organic chemistry

### Learning aims

The student gains competence in

- deciding, on the basis of extended natural science and technical process knowledge, which raw materials can be used for the production of the different fibres,
- scientific classification of the different raw materials used in paper production,
- understanding the chemical processes in the production of fibres, and for bleaching,
- selecting the necessary fibre material, on the basis of scientific criteria and to use this confidently in the development of products,
- making a critical analysis of the different processes, on the basis of discussion and presentation of different case studies.

### Contents

- The chemical and morphologic structure of wood and cellulose fibres.
- Fibre chemistry: cellulose, polysaccharides, lignin and extracted material.
- Chemical pulping of wood in detail: sulphite, Kraft, and solvent processes; technical plant for the production of pulp.
- Bleaching pulps (oxidizing + reducing) with technical process background.
- Technical procedures used in processing wood and the production of chips.
- Special procedures for the production of mechanical wood pulp and mechanical fibres.
- Newest developments in the field of pulp and wood cellulose production.
- Evaluation of the suitability of the different types of wood for the production of pulp.

### Literature

Papermaking Science and Technology, Volume 5, Mechanical Pulping, edited by Jan Sundholm  
Papermaking Science and Technology, Volume 6, Chemical Pulping, edited by Johan Gullichsen and Carl-Joahn Fogelholm

### Proof of Proficiency

Written Examination (50 %) + Student project (50 %)

## MPW 4 Module: Stock Preparation

<b>Course</b>	
Semester	2
Credits	5
Workload	Lectures/exercises: 24 hrs. Preparation and evaluation time: 51 hrs. Student project 75 hrs.
Person Responsible for Module	Dr. David Croll
Method of Instruction	Lectures, Exercises, Group discussions on pulp preparation systems, Project work
Language	English
Media Used	Laptop, Beamer presentation, Overhead projector, Blackboard, Sample folders and Demonstration material.

### Lecturer

Dr. David Croll

### Prerequisites

Introduction to Paper Technology

### Learning aims

The student

- knows the theory of the technical aspects of machinery, raw materials, and processes in the field of pulp preparation,
- is able to analyse and design stock preparation systems, can work out suggestions for improvements, and explain the connections between the properties of paper, the steps in the manufacturing process and the raw materials used,
- can select suitable stock-preparation systems, including the choice of raw materials and the dosage points for different qualities of paper.

Intensive study of the natural materials involved (cellulose fibre, fillers, dissolved matter, recycled paper) increases competence in the methodology of natural sciences.

### Contents

- Aims of, and processes used in pulp preparation.
- Physical and chemical criteria for the selection of fibres for pulp preparation.
- Recycled fibre pulp preparation processes.
- Enhanced technical aspects of the processes used in pulp preparation.
- Energetic aspects of pulp preparation.
- Design of pulp preparation systems.
- Influencing the characteristics of paper through the pulp preparation system.

### Literature

Current publications by machine manufacturers, paper suppliers, paper manufacturers, and research institutes.

G. A. Smook, Handbook for Pulp & Paper Technologists, Joint Textbook Committee of the Paper Industry - TAPPI and CPPA

### Proof of Proficiency

Written Examination (50 %) + Student Project (50 %)



## MPW 5 Module: Paper Testing with Lab Work

<b>Course</b>	
Semester	3
Credits	5
Workload	Lectures, exercises, practical work: 48 hrs. Preparation and evaluation time: 102 hrs.
Person Responsible for Module	Prof. Dr. Heinz Ziegler
Method of Instruction	Lectures; Exercises; Practical work
Language	English
Media Used	Laptop, Beamer presentation, Overhead projector, Blackboard, Flip Chart

### Lecturers

Prof. Dr. Heinz Ziegler + Dipl.-Ing. (FH) Jürgen Belle

### Prerequisites

Basic knowledge of statistics, Introduction to Paper Technology

### Learning aims

The students know the measurement techniques used, and their limitations.

- The students comprehend the theoretical knowledge and the practical application of optical and physical measuring and testing techniques.

The students are able to:

- Work independently when considering the physical characteristics of paper and carrying out different methods of testing,
- Determine complex connections between faults in paper and suitable methods of testing, together with the results of these, also to apply these in optimizing production and/or converting processes,
- Identify the properties of unknown types of paper, and to determine their uses and limitations,
- Present and discuss the results in a technical presentation, with a critical audience.

### Contents

- Important aspects for avoiding errors when taking samples and considering the statistical evaluation of measurements.
- Methods of testing pulp and paper, as well as applying these independently, in small groups
- Physical and chemical properties of fibre materials and fibre suspensions.
- Important properties of paper: Surface-related factors, mass, thickness, volume, moisture content.
- Strength properties: Dynamic strength, static strength, surface strength, dimensional stability of paper, structure of paper, surface topography, optical properties, dynamic behaviour in the presence of liquids.

## Literature

Various DIN, ISO, Tappi and SCAN norms and standards

Prüfung von Papier, Pappe, Zellstoff und Holzstoff, Band 2 und 3, Herausg.: W. Franke et al., Heidelberg, Springer 1993

Levlin, Jan-Erik; Söderhjelm, Liva: Pulp and Paper Testing (Papermaking Science and Technology, Book 17). Fapet Oy, Helsinki, 1999

Niskanen, Kaarlo: Paper Physics (Papermaking Science and Technology Book 16). Fapet Oy, Helsinki, 1998

Makrström, Hakan: The Elastic Properties of Paper - Test Methods and Measurement Instruments. Lorentzen & Wettre, Stockholm, 1991

Pauler, Nils: Optische Papiereigenschaften. AB Lorentzen & Wettre, Kista.

## Proof of Proficiency

Written examination (70 %); Oral examination (30 %)

## MPW 6 Module: Paper Chemistry

Course	
Semester	2
Credits	5
Workload	Lectures, attendance time, including experiments: 48 hrs. Preparation and evaluation time, working out case studies and presentations: 102 hrs.
Person Responsible for Module	Prof. Dr. Stephan Kleemann
Method of Instruction	Lectures, exercises (individual and group work); Laboratory work Student project with presentation
Language	English
Media Used	Beamer presentation, Overhead projector, Flip-chart, Blackboard, Demonstration of laboratory equipment.

### Lecturers

Prof. Dr. Stephan Kleemann + Dipl.-Ing. (FH) Jürgen Belle

### Prerequisites

Basic knowledge of organic and general inorganic chemistry, Introduction to Paper Technology

### Learning aims

The student is able to:

- Apply the principles of general, inorganic and organic chemistry, and to explain the reaction mechanisms of organic chemistry in depth.
- Determine the main characteristics of compounds, on the basis of their functional chemical groups.
- Suggest projects, including complex projects, to solve chemical problems which may occur.
- Recognize the interactions that take place in the course of the processes and, as part of a team, to follow the course of processes - also under changing conditions.
- Test and optimize the use of chemical additives at a laboratory scale.

### Contents

- 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.

### 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 Academic & Professional, ISBN 0 7514 0236 2 (1996)

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

### Proof of Proficiency

Written Examination (100 %)

## MPW 7 Module: Minerals

<b>Course</b>	
Semester	2
Credits	5
Workload	Lectures and exercises: 24 hrs; Preparation and evaluation time, working on case studies and presentations: 51 hrs; written-up student project: 75 hrs;
Person Responsible for Module	Prof. Dr. Thoralf Gliese
Method of Instruction	Lectures, exercises (individually and in group work), laboratory work, student project work with presentation
Language	English
Media Used	Blackboard, Laptop, Beamer presentation, Overhead projector, Flip-Chart, Demonstration of laboratory equipment.

### Lecturer

Prof. Dr. Thoralf Gliese

### Prerequisites

Knowledge of general inorganic chemistry, Introduction to Paper Technology

### Learning aims

The students are able to understand processes in the fields of screening, filtering and classification, and to explain these.

They have detailed knowledge of the natural materials chalk, lime, kaolin, dispersion aids and other additives.

The student is able to

- recognize the connection between cause and effect in the area of mineral components,
- suggest projects, including complex projects for the synthesis of mineral materials as well as for the solution of problems arising with fillers and pigments,
- explain the interactions that take place in the course of the processes and, as part of a team, follow the course of the processes - also under changing conditions.

Contents

- Structure, occurrence and preparation of mineral materials, 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 materials in the first application and in recycling
- Consideration of ecological and economic aspects in relation to the products discussed

### Literature

Script Prof. Dr. T. Gliese „Minerals“

F. W. Tegethoff (Editor) - „Calciumcarbonat - From the Cretaceous Period into the 21st 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

### Proof of Proficiency

Written Examination (50%), 1 written-up student project (50%)

## MPW 8 Module: Automation I

<b>Course</b>	
Semester	1
Credits	5
Workload	Lectures and exercises: 48 hrs. Preparation and evaluation time: 102 hrs.
Person Responsible for Module	Dr. Reinhard Müller
Method of Instruction	Lectures, Exercises (individually and in group work), Practical work, Field trip
Language	English
Media Used	Beamer presentation, Blackboard, Sample folders

### Lecturer

Dr. Reinhard Müller

### Prerequisites

Knowledge of mathematics, physics and chemistry

### Learning aims

The student

- knows and understands the principles of measurement and control techniques and 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 application of programmable storage control systems, as well as comprehensive hierarchically constructed and decentralized automation systems, as well as their application in technical process equipment.
- can understand complex information 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 quality and process control systems.

### Contents

Increasing knowledge of the principles of mathematics - vector analysis, special differential equations, Laplace transformation, transfer functions,

- Sensors and correcting control elements, measurement and control elements,
- Feed-forward and feed-back control systems,
- Design control elements for linear and nonlinear systems,
- Nyquist Method,
- Lyapunov stability criteria for linear and non-linear systems.
- Quality and process control systems
- Machine-direction profile and cross-direction profile control,
- Batch and continual processes.

## Literature

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

## Proof of Proficiency

Written Examination (100 %)

## MPW 9 Module: Automation II

Course	
Semester	2
Credits	5
Workload	Lectures and exercises: 24hrs. Preparation and evaluation time: 51hrs. Student project work: 75hrs.
Person Responsible for Module	Dr. Reinhard Müller
Method of Instruction	Lectures, Exercises, Practical work, Field trips
Language	English
Media Used	Beamer presentation, Blackboard, Sample folders

### Lecturer

Dr. Reinhard Müller

### Prerequisites

Automation I

### Learning aims

The student has a deeper knowledge in the fields of

- process and factory automation, with regard to modern control concepts, and their application in complex process-control systems,
- data storage and data analysis,
- modern concepts for system networks (Linking),
- bus, communications and Information systems
- production-planning systems (PPS),
- company and management systems (ERP)
- is able to
- analyse the efficiency of automation systems,
- compare and evaluate the efficiency of different automation solutions,
- find new possibilities of use for existing automation systems,
- use methods of obtaining information on optimal process guidance from large amounts of data,
- analyse and solve new problems, using simulations.

### Contents

- Modern measurement procedures:
- Non-scanning,
- Virtual sensorics,
- Self-organising maps (SOM),
- Ramifications,
- 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:
- Concept for adjustability and monitoring in non-linear systems

- Phase vector and phase space
- State feedback design
- Process-control systems with random input magnitude
- Process-control systems by means of optimization (performance index)
- Intelligent field equipment, HART protocol.
- Field-bus and networks,
- System communication,
- Visualization and information systems
- Systems for monitoring machine condition, and diagnosis
- Web-inspection systems
- Systems for the recognition of breaks in the web and other problems (Event Capturing)
- Communications and management systems Applications

## Literature

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

## Proof of Proficiency

Oral Examination (50 %) + Student project work (50 %)



## MPW 10 Module: Board and Paper Technology I

<b>Course</b>	
Semester	2
Credits	5
Workload	Lectures, exercises: 48 hrs. Preparation and evaluation time: 102 hrs.
Person Responsible for Module	Prof. Dr. Stephan Kleemann
Method of Instruction	Lectures, exercises, practical work, Field trip
Language	English
Media Used	Laptop, Beamer presentation, Overhead projector

### Lecturers

Dipl.-Ing. Ulrich Begemann + Dipl.-Ing. Harald Hess

### Prerequisites

Introduction to Pulp and Paper Technology, Pulp Technology, Stock Preparation

### Learning aims

The student has acquired the ability to

- explain the technical processes used for pulp and stock preparation in the paper and packaging material industries - with emphasis on those processes used in recycling waste paper,
- describe in detail the construction of the machines used in the paper and packaging material industries, and the course of the processes,
- calculate those variables relevant to paper production and work out enhanced engineering solutions to problems, in a team.

### Contents

- 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 paper and packaging material production.
- Criteria and calculations for setting up a pulp-preparation unit for paper and packaging material machines.

### Literature

Papermaking Science and Technology, Volume 8-10,  
Papermaking Part 1-3, Fapet Oy, Finland, ISBN 952-5216-14-4

### Proof of Proficiency

Written Examination (100 %)

## MPW 11 Module: Board and Paper Technology II

<b>Course</b>	
Semester	3
Credits	5
Workload	Lectures, exercises: 24 hrs. Preparation and evaluation time: 51 hrs. Student project work: 75 hrs.
Person Responsible for Module	Prof. Dr. Stephan Kleemann
Method of Instruction	Lectures, Exercises, Practical work, Field trip
Language	English
Media Used	Laptop, Beamer presentation, Overhead projector

### Lecturers

Dipl.-Ing. Ulrich Begemann + Dipl.-Ing. Harald Hess

### Prerequisites

Board and Paper Technology I, Paper Chemistry

### Learning aims

The students are able to explain in detail the processes in the production of paper and packaging material and the machines used for these. On the basis of laboratory work closely-related to the factory situation or through production on an experiment paper or coating machine, they demonstrate the ability to put their acquired knowledge of engineering into practice in a team, and to present it in the form of a report.

### Contents

- Processes used in the preparation of fibre stock suspensions on the basis of primary and secondary fibres (recycled paper).
- The technical knowledge of the processes used, and important parameters for the selection of suitable measures and machinery for the solution of the problem of breakdowns during paper production.
- Technical processes and machine construction possibilities for paper and board production.
- Paper production, on a technical scale, on an experimental paper-machine and/or an experimental coater. Guidance for the preparation and presentation of a student project on the theme Board and Paper Technology.

### Literature

Papermaking Science and Technology, Volume 8-10,  
Papermaking Part 1-3, Fapet Oy, Finland, ISBN 952-5216-14-4  
Anleitungen zum Betrieb der Kämmerer Versuchspapiermaschine

### Proof of Proficiency

Oral Examination (50 %) + Student project work (50 %)

## MPW 12 Module: Coating I

<b>Course</b>	
Semester	3
Credits	5
Workload	Lectures, exercises: 48 hrs. Preparation and evaluation time: 102 hrs.
Person Responsible for Module	Prof. Dr. Thoralf Gliese
Method of Instruction	Lectures, Exercises, Practical exercises, Field trips
Language	English
Media Used	Laptop, Beamer presentation, Overhead projector

### Lecturer

Prof. Dr. Thoralf Gliese

### Prerequisites

Introduction to Paper Technology, Thermodynamics + Chemical Engineering

### Learning aims

The student has acquired the ability to

- explain the principles of rheology and physics in detail,
- discuss coating of raw paper and the rheology problems connected with this, on the basis of his detailed knowledge of rheology and interface physics,
- understand, through his enhanced knowledge of the principles of mathematics, the effects of coating on important paper parameters and on the printability of paper, also analysis and quality evaluation of these,
- discuss the determination of the characteristic magnitudes found in the dynamic, non-stationary processes, sometimes under extreme shear forces,
- explain, plan and calculate the complex composition of a coating pigment.
- Intensive study of the physical phenomena involved increases competence in the field of natural science methodology.

### Contents

- 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.

### 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

### Proof of Proficiency

Written Examination (100 %)

## MPW 13 Module: Coating II

<b>Course</b>	
Semester	4
Credits	5
Workload	Lectures, exercises: 24 hrs. Preparation and evaluation time: 51 hrs. Student project work: 75 hrs.
Person Responsible for Module	Prof. Dr. Thoralf Gliese
Method of Instruction	Lectures, Exercises, Practical exercises, Field trips
Language	English
Media Used	Beamer presentation, Overhead projector, Samples

### Lecturer

Prof. Dr. Thoralf Gliese

### Prerequisites

Coating I, Thermodynamics + Chemical Engineering

### Learning aims

The student is able to

- deduce in detail the technological phenomena occurring in the interface processes and their characteristic magnitude,
- to 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,
- to 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 Masters level.

Through practical applications, knowledge of application in engineering is increased.

### Contents

- Calculation and preparation of coating pigments - taking into account rheological aspects
- Coating/spraying of raw paper and the problems connected with this, on the basis of laboratory equipment.
- The effect of the coating process on important characteristics of paper and on printability, and analysis of problems which occur.
- Possible processes for coating paper and packaging materials, and putting these into practice in the laboratory and on a technical scale.

### 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

### Proof of Proficiency

Oral Examination (50 %) + Student project work (50 %)

## MPW 14 Module: Printing Technology

<b>Course</b>	
Semester	2
Credits	5
Workload	Lectures, exercises: 24 hrs. Preparation and evaluation time: 51 hrs. Student project-work: 75 hrs
Person Responsible for Module	Dipl.-Ing. (FH) Heinz Ullrich
Method of Instruction	Lectures, Practical exercises, Field trips
Language	English
Media Used	Beamer presentation, Overhead projector, Larger numbers of correct and faulty printing samples

### Lecturers

Prof. Dr. Heinz Ziegler + Dipl.-Ing. (FH) Heinz Ullrich

### Prerequisites

Introduction to Paper Technology; Thermodynamics and Chemical Engineering

### Learning aims

The student is able to,

- explain the techniques of different printing processes and their interaction with the material to be printed,
- understand the complex phenomena of adsorption and desorption, taking into account the hysteresis behaviour of paper in conjunction with the printing processes,
- 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 and to describe the faults 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, in a team - cataloging the problems and considering possible solutions.

### Contents

- The principles of processing and technology of the most important methods of printing.
- Sample conditioning - adsorption / desorption and hysteresis behaviour.
- 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 ability to evaluate printing products.

### Literature

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

### Proof of Proficiency

Schriftliche Prüfung (70 %) + Student project work (30 %)

## MPW 15 Module: General Management I

<b>Course</b>	
Semester	1
Credits	5
Workload	Lectures and exercises: 48hrs. Preparation and evaluation time: 102hrs.
Person Responsible for Module	Dr. Manfred Sargl
Method of Instruction	Lectures, Group work, Case studies, Presentation (preparation and presentation), Field trip
Language	English
Media Used	Blackboard, Beamer presentation, Overhead projector, Flipchart, Pin-board

### Lecturer

Dr. Manfred Sargl

### Prerequisites

Basic knowledge of business management and mathematics

### Learning aims

The student is able to

- work with complex information, regarding the rating of concerns and in the field of balance analysis, using methods involving mathematics and statistics,
- understand and apply current theories on calculation of investments and financing, also the tools used for this,
- carry out statistical and dynamic investment planning - with certain and uncertain factors on the basis of concrete problems, and explain their interdisciplinary significance.

### Contents

- Theory and practice in calculation of investments and financing.
- Distinguishing characteristics in finance, as well as interpretation of these, on the basis of concern ratings and balance analysis as examples.
- Analysis of balances and company reports.
- Possibilities of calculating investments and financing taking into account the uncertainty of decisions.

### Literature

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

### Proof of Proficiency

Written Examination (100 %)

## MPW 16 Module: General Management II

<b>Course</b>	
Semester	3
Credits	5
Workload	Lectures, exercises: 24hrs. Preparation and evaluation time: 51hrs. Student project work: 75hrs.
Person Responsible for Module	Dr. Manfred Sargl
Method of Instruction	Lectures, Exercises, Group work, Presentations, Case studies
Language	English
Media Used	Blackboard, Flipchart, Beamer presentation, Overhead projector

### Lecturer

Dr. Manfred Sargl

### Prerequisites

Basic knowledge of business management

### Learning aims

- The students comprehend the theoretical methods and concepts of management, are able to define their practical significance, and apply these theories independently.
- The increased competence in economics will be tested, using actual model calculations.
- The students are able to:
  - understand business management methods, arrange them in their order of importance in practice, and to apply these theories independently,
  - calculate and apply the distinguishing characteristics and the interpretation of these, using concern rating and balance analysis as a basis,
  - relate these distinguishing characteristics to the medium and long-term development of the company,
  - work out questions of strategy, on a medium and long-term basis, as well as integrating possible aids for strategic development, think in an analytically integrated way, especially through quick recognition of problems, and find solutions to these problems by methodical application of knowledge of the different fields of management.

### Contents

- Use of distinguishing characteristics as a means of measuring economic processes and to explain the taxation level function.
- How to analyse balances and business reports.
- Theory and current research in the field of strategic management - competition strategies, financial planning, market analysis.

### Literature

Strategic Management and Business Policy: Concepts and Cases

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

### Proof of Proficiency

Oral examination (50 %), Student project work with presentation (50%)

## MPW 17 Module: Elective Intensive

Course	Machine Dynamics
Semester	1
Credits	5
Workload	Lectures, exercises: 48 hrs. Preparation and evaluation time: 102 hrs.
Person Responsible for Module	Prof. Dr. Werner Hübner
Method of Instruction	Lectures; Exercises at the blackboard; supervision in groups; Field trips
Language	English
Media Used	Complete script, as hard copy; Beamer presentation and/or transparencies on overhead projector; Demonstrations on equipment, e.g. a Cardan circle.

### Lecturer

Prof. Dr. Werner Hübner

### Prerequisites

Basic knowledge of kinematics und kinetics, as well as of differential equations and matrix calculations

### Learning aims

The student is able to

- become familiar with complex machinery systems,
- solve complex interdisciplinary problems independently,
- implement new and further development of technical systems, while taking into consideration operating practices, in order to obtain results suitable for application,
- develop a deeper understanding of machine dynamics for phenomena relevant to paper machines, and for problems arising with the machines,
- carry out work on projects, as a member of a team or as team leader,
- present the results of his/her work, in a technical presentation, to a critical audience.

### Contents

- Knowledge of machine construction, at a deeper level.
- Fixed-body kinetics, vibrations, multi-bodied systems.
- Trouble shooting - with complex examples from the industrial practices of paper and packaging technology.

### Literature

Erwin Krämer: Dynamics of Rotors and Foundations Springer, Berlin. 1993

Graham Kelly: Mechanical Vibrations (Schaum's Outline Series) McGraw-Hill, New York. 1996

### Proof of Proficiency

Written Examination (100 %)



## MPW 17 Module: Elective Intensive

Course	Design and Analysis of Experiments
Semester	1
Credits	5
Workload	Lectures, exercises: 48 hrs. Preparation and evaluation time: 102 hrs.
Person Responsible for Module	Prof. Dr. Volker Abel
Method of Instruction	Lectures, Exercises
Language	English
Media Used	Laptop, Beamer presentation, Overhead projector, Blackboard

### Lecturer

Prof. Dr. Volker Abel

### Prerequisites

Knowledge of mathematics and statistics

### Learning aims

The students increase their competence in mathematics and master the theory and practice of statistical planning and evaluation of experiments on the basis of statistics.

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

The students are able to

- select statistical procedures and to apply these confidently,
- draw up a suitable plan for the solution of a given technical or scientific problem,
- recognize and explain the advantages and disadvantages of such plans,
- present and evaluate the results of experiments in detail, on the basis of their enhanced knowledge about statistics.

### Contents

Uni- and multi-dimensional data, questions of normal distribution, the principles of tests of significance, and how to deal with questions involving statistical intervals.

Work with:

- complete factorial experimental designs
- factorial experimental partial experimental designs
- response surface designs
- mixed designs
- contrast coefficient methods
- analyse of variance
- multiple regression

### Literature

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

Additional literature will be announced at the beginning of the course.

### Proof of Proficiency

Written Examination (100 %)

## MPW 18 Module: Technical Elective

Course	Electromechanical Engineering
Semester	3 / 4
Credits	2,5
Workload	Lectures, exercises: 24 Std.; Preparation and evaluation time: 51 Std.;
Person Responsible for Module	Dr. Reinhard Müller
Method of Instruction	Lectures, Exercises, Field Trip
Language	English
Media Used	Beamer presentation, Blackboard

### Lecturer

Dr. Reinhard Müller

### Prerequisites

Knowledge of mathematics and physics

### Learning aims

The students are able to:

- solve interdisciplinary problems in the boundary area between electro-technology and machine construction independently.
- present the results of their work, in technical presentations, to a critical audience.

The student has mastered the construction principles of mechatronic systems, also when using simulation tools.

### Contents

- Mechatronic systems and components
- Construction of models
- Static and dynamic behaviour
- Simulation tools
- Actuators; sensors; feedback regulation systems
- Synthesis of mechatronic systems
- Construction elements
  - Electrical and electronic circuits and components
- Construction and method of operation of motors and generators
  - Direct current, alternating current, synchronous-, servo-stepper

### Literature

Schaum's Outline of Electric Machines & Electromechanics by Nasar  
ISBN 0070459940 / 9780070459946

### Proof of Proficiency

Written Examination (50 %)

## MPW 18 Module: Technical Elective

Course	Process and Machinery Technology
Semester	3/4
Credits	2,5
Workload	Lectures, exercises: 24 hrs. Preparation and evaluation time: 51 hrs.
Person Responsible for Module	Prof. Dr. Stephan Kleemann
Method of Instruction	Lectures, Exercises, Field Trip
Language	English
Media Used	Blackboard, Foils + Beamer presentation

### Lecturer

Prof. Dr. Stephan Kleemann

### Prerequisites

Thermodynamics and Chemical Engineering, Introduction to Paper Technology

### Learning aims

The students know the phases, methods and procedures in the development of processes and machines. The students can apply important methods of development under co-operative learning situations (group work).

Competences gained: The students

- master the actions and connections between technical (mechanical, thermic and reaction) processes, apparatus and machines,
- understand the use of material, energy and information in the technical installations,
- know the principles of management for the planning project for a plant,
- know the procedures (feasibility study, determining the preliminary planning, planning the basic design and details) of the installation,
- are familiar with the methods of planning plants and are able to apply these purposefully,
- can define, analyse, solve, and document technical planning requirements.

### Contents

Systematic overview of process techniques:

Operating principles, arrangement and selection of apparatus and machines, according to their planned use.

Tasks and course of the construction and planning of the plant:

Method of carrying out the project; communication and technical documentation when planning the plant (description of procedure, pictures of progress sequence; selection and coordination of processes and equipment in a plant; arrangement of conveyor systems; arrangement of the rooms (construction method, location plan, planning the required pipe systems); special planning tasks - process control technology, insulation and steel construction; planning deadlines, capacity and costs.

Consideration of examples of the planning of selected plants.

### Literature

Kasper, W.: Verfahrenstechnische Anlagen. Planung, Bau und Betrieb. WILEY-VCH

Hirschberg, H.-G.: Handbuch Verfahrenstechnik und Anlagenbau. Chemie, Technik und Wirtschaftlichkeit. Springer-Verlag

Bernecker, G.: Planung und Bau verfahrenstechnischer Anlagen. Springer-Verlag

### Proof of Proficiency

Written Examination (50 %)

## MPW 18 Module: Technical Elective

Course	Clothing
Semester	3 / 4
Credits	2,5
Workload	Lectures/group work: 24 hrs. Preparation and evaluation time: 51 hrs.
Person Responsible for Module	Dipl.-Ing., MBA Axel Burmeister
Method of Instruction	Lectures, Group work: work on a case study with presentation of results, Field trip
Language	English
Media Used	Beamer presentation, Overhead projector, Blackboard, Flip Chart, Sample folders, Demonstration material

### Lecturer

Dipl.-Ing., MBA Axel Burmeister

### Prerequisites

Knowledge of organic chemistry, Introduction to Paper Technology

### Learning aims

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.

### Contents

- Synthesis, chemical structure, physical and chemical properties, as well as the range of application of plastics.
- General construction, method of manufacture and the technical properties of the wet fabric-sieve, 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 these methods and knowledge for the structured solution of specific engineering problems.

### Literature

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

### Proof of Proficiency

Written Examination (50 %)

## MPW 18 Module: Technical Elective

Course	Specialty Papers
Semester	3 / 4
Credits	2,5
Workload	Lectures / exercises: 24 hrs. Preparation and evaluation time: 51 hrs.
Person Responsible for Module	Dr. Helga Zollner-Croll
Method of Instruction	Lectures, Case studies in group work, Presentations of case studies Analysis of demonstration material
Language	English
Media Used	Laptop, Beamer presentation, Overhead projector, Blackboard, Samples

### Lecturer

Dr. Helga Zollner-Croll

### Prerequisites

Introduction to Paper Technology

### Learning aims

The students have a deeper 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 increases competence of the students 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.

### Contents

In this course, the following topics are covered, in order to increase knowledge of their engineering applications:

- The different sorts of paper, classification possibilities and market data (consumption vs. production)
- Special fibres as raw materials, and the necessary preparation possibilities for the production of specialities.
- Detailed knowledge of the production of hygiene papers, 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.

### Literature

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

### Proof of Proficiency

Written Examination (50 %)

## MPW 19 Module: General Elective

Course	Intercultural Communication
Semester	3 / 4
Credits	2,5
Workload	Lectures and exercises: 24 hrs.; Preparation, finishing off and working out case studies and presentations: 51 hrs.;
Person Responsible for Module	B.A., M.A. Annabelle Wolff
Method of Instruction	Lectures, Practice (individually and in group work), Case studies + role play (in group work), Presentations (in group work)
Language	English
Media Used	Beamer presentation, Overhead projector, Blackboard, Flip chart + pin-boards

### Lecturer

B.A., M.A. Annabelle Wolff

### Prerequisites

None

### Learning aims

The students gain the competence and ability to behave, and conduct transactions, in a way which shows regard for a foreign culture. Their intercultural competence is strengthened by increasing their awareness of their own concepts and those of others.

On completion of the course, the students are able to analyse their own culture, to analyse 'other' cultures, to adapt to cultural dimensions and to train their awareness and behaviour.

The sensitization process is the key to successful contacts with other cultures, which the students may encounter later in their professional life.

### Contents

Introduction to the term culture

- - Cultural dimensions, according to G. Hofstede
- - The theory of intercultural communication
- - The ethnography of communication
- - Culture-shock phases
- - Stereotypes and prejudices
- - Cases, from everyday life
- - Training in awareness and behaviour
- - Role play and simulation in intercultural contact
- - Imparting the basis for team work.

### Literature

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

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.

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

### Proof of Proficiency

Written Examination (50 %)

## MPW 19 Module: General Elective

Course	Patent Law - Protection of Intellectual Property
Semester	3 / 4
Credits	2,5
Workload	Lectures/ exercises 24 hrs. Preparation and evaluation time, 51 hrs.
Person Responsible for Module	Patent Lawyer Dr.-Ing. Ulrich Wittmann
Method of Instruction	Lectures; Exercises, based on examples of cases; Field trip to the German Patent and Trademark Office or the Federal Patent Court
Language	English
Media Used	Beamer presentation, Overhead projector, Demonstration material

### Lecturer

Patent Lawyer Dr.-Ing. Ulrich Wittmann

### Prerequisites

Introduction to Paper Technology

### Learning aims

The students develop a deeper 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, trade marks, and designs, in the fields of science and engineering, and understand the application of the employee inventions regulation.

They can take over 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.

### Contents

The theoretical basis of commercial patent rights and international patent rights (patent law, trademark rights, design patent law, licence rights).

German and European Patent Law, as well as employee invention regulations.

Work through case examples in the fields 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.

### Literature

Patent- und Musterrecht, Beck texte im dtv; Wettbewerbsrecht, 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

### Proof of Proficiency

Written Examination (50 %)

## MPW 19 Module: General Elective

Course	Project Management
Semester	3 / 4
Credits	2,5
Workload	Lectures, exercises: 24 hrs; Preparation, finishing off, and working out case studies, and presentations: 51 hrs.
Person Responsible for Module	Prof. Dr. Heinz Ziegler
Method of Instruction	Lectures, Exercises (individually and in group work), Case studies (in group work), Presentations (in group work)
Language	English
Media Used	Beamer presentation, Overhead projector, Blackboard, Flipchart, Pin boards

### Lecturer

Prof. Dr. Heinz Ziegler

### Prerequisites

None

### Learning aims

The students gain the interdisciplinary competence to

- draw up plans for a proposed project, including for complex projects,
- prepare a plan for a project, including with closely cross-linked part-projects,
- monitor and follow the course of processes and the use of resources, including under changing conditions, until successful completion of the project,
  - evaluate these projects.

After completion of the course, the student is in a position to

- plan and monitor complex projects independently,
- work as project manager, including with difficult and/or complex project teams,
- solve complicated problems together with a team,
  - present multi-level results with the team, in a form which can be understood.

### Contents

- Preparation of a project charter, co-operation in a project team, and the role of the project manager, preparation of a project plan, completion of a project, summarizing and evaluation of a project.
- Imparting the principles of working in a group.
- Preparation of case studies (in teams), practical work (in teams and as individuals), and presentation of results as a team.

### Literature

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..

Kerzner, Harold. Project Management: A Systems Approach to Planning, Scheduling, and Controlling. New York, John Wiley & Sons, Inc., latest ed..

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

Martin, Paula; Tate, Karen. Project Management Memory Jogger: A Pocket Guide for Project Teams.

Methuen, GOAL/QPC, latest ed.. (in Germany sold by TQU Verlag Ulm)

### Proof of Proficiency

Written Examination (50 %)



## MPW 20 Module: Project

<b>Course</b>	
Semester	3
Credits	5
Workload	Attendance time: 24 hrs.; project work: 126 hrs.
Person Responsible for Module	Professors of the Master Course in Paper Technology
Method of Instruction	Independent work (with supervision and guidance)
Language	English
Media Used	Beamer, for the student's presentation

### Lecturers

Professors and Lecturers of the Master Course in Paper Technology

The project can also be carried out in an institute /firm outside the University.

### Prerequisites

2 complete semesters of study

### Learning aims

The project enables the students to do scientific work independently, at Masters level, and increases their ability to carry out experiments in order to:

- Practise and apply the methodology of scientific work,
- use scientific theories in practical applications,
- do experimental and theoretical work.

The students achieve competence to

- become familiar with complex systems quickly,
- do scientific work and practical research independently,
- do project work, as a team member or as team leader,
- organize appropriate project work,
- present the results of their work, in a technical presentation, to a critical audience.

### Contents

Independent scientific work:

- with research in the literature,
- Project structure, time planning and preparation of a concept,
- Planning and carrying out experiments,
- Evaluating the results of the experiments,
- Data analysis and backing up the experiments.

Prepare a written scientific project paper, and then give a presentation on the results.

### Literature

Will be recommended at the beginning of the project

### Proof of Proficiency

Project work with write-up (70%) and presentation (30%)

## MPW 21 Module: Master Thesis

Course	
Semester	4
Credits	20
Workload	600 hrs.
Person Responsible for Module	Professors of the Master Course in Paper Technology
Method of Instruction	Independent scientific work, with supervision by the University.
Language	English
Media Used	Beamer presentation, Blackboard (for the oral examination)

### Lecturers

Professors and Lecturers of the Master Course in Paper Technology

Work for the Master Thesis can also be done in an institute / firm outside the University if it can be supervised by an appropriate person from the University.

### Prerequisites

Those modules which apply to the task, 3 completed semesters of study.

### Learning aims

The Masters Thesis increases and tests the students' competence in methodology in the fields of 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.

### Contents

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

Themes 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.

### 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.Bliedert, W.E.Russey, Verlag Wiley-VCH (2004)

### Proof of Proficiency

Written Master Thesis and colloquium