Course Descriptions for the Joint Study Programme
"International Master of Science in Engineering, Entrepreneurship and Resources (MSc. ENTER)

Version 09.2019

Courses at **Technische Universität Bergakademie Freiberg**
with the Specialization "**Mechanical and Process Engineering**"

Module Name	**Training in Particle Technology**
ECTS Credits	**4**
Responsible	Urs A. Peuker, Prof. Dr.-Ing.
Lecturer(s)	Research assistants at the Institute of Mechanical Process Engineering and Mineral Processing
Institute(s)	Institute of Mechanical Process Engineering and Mineral Processing
Duration	1 Semester (winter)
Teaching Language	English
Learning Outcome (Competencies)	The module aims at recalling the fundamentals of particle technology. It is set up using special exercises to practice scientific and technological calculations of particle size distributions and fundamental microprocesses. The principles of the mechanical micro-processes are introduced. The exercises also apply the fundamental approaches (micro-processes) to describe and to design process equipment. This will be done using case studies.
Contents	Particle characterization Particle size distribution Mixing of particle size distributions Separation of particle size distributions (classification) Grade recovery curves Micro processes in particle technology • Particles in flow-fields (i.e. sedimentation) • Flow through porous media • Particle-particle interactions (e.g. van-der-Waals-forces, • electrostatic interactions, DLVO-theory, capillary forces) • Breakage laws (i.e. breakage energy) Selected case studies form the fields: • Filtration • Sedimentation • Agglomeration • Classification • Comminution • And others
Teaching Methods	Lectures – Recall of fundamentals (1 semester week hour) Case studies / Exercises – Application of fundamentals (2 semester week hours)

Assessment Methods	For the award of credit points it is necessary to pass the module exam, which contains: • oral exam (min. 30 minutes) or written exam (120 minutes, if 8 students or more)
Grading	The grade is generated from the examination result(s) with the following weights (w): • oral exam/written exam (1)
Materials/literature	M. Stieß: Mechanische Verfahrenstechnik 1 - Partikeltechnologie, Springer-Verlag, Berlin, Heidelberg, 2009 H. Schubert: Handbuch der Mechanischen Verfahrenstechnik, Wiley-VCH, Weinheim, 2003 selected scientific papers
Workload	120 (attendance: 45 h; self-studies: 75 h)

Module Name	**Training in Endurance and Design**
ECTS Credits	**6**
Responsible	Matthias Kröger, Prof. Dr.
Lecturer(s)	Matthias Kröger, Prof. Dr. Robert Szlosarek, Dr.
Institute(s)	Institute for Machine Elements, Engineering Design and Manufacturing
Duration	1 Semester (winter)
Teaching Language	English
Learning Outcome (Competencies)	The students are able to analyze and design machine elements and machines. The students can dimension the main machine elements and can give a prediction of the endurance of these elements.
Contents	The module focuses on the following topics: • Introduction in a CAD system • Dimensioning of components for static and cyclic loadings • Load analyzes of measured force or stress data • Design of shaft bearing systems and endurance calculation of bearings • Selection and calculation of screws and screw junctions • Endurance of gears and design of gear boxes • Own design and dimensioning of a bearing system and a gear box
Teaching Methods	Lectures (1 semester week hour) Exercises (2 semester week hours) Practical application (1 semester week hour)
Pre-requisites	Recommendations: basic knowledge in engineering design
Assessment Methods	For the award of credit points it is necessary to pass the module exam, which contains: • Pre-exam assessments – dimensioning and technical design • written exam (120 minutes) Before the exam, the pre-exam assessments have to be satisfied.
Grading	The grade is generated from the examination result(s) with the following weights (w): • written exam (1)
Materials/literature	V. B. Bhandari: Design of Machine Elements, Fourth Edition. Mc Graw Hill Education, India (2016).

Workload	180 (attendance: 60 h; self-studies: 120 h)

Module Name	**Conception of Process Equipment**
ECTS Credits	**3**
Responsible	Urs A. Peuker, Prof. Dr.-Ing.
Lecturer(s)	Urs A. Peuker, Prof. Dr.-Ing.
Institute(s)	Institute of Mechanical Process Engineering and Mineral Processing
Duration	1 Semester (winter)
Teaching Language	English
Learning Outcome (Competencies)	The aim is the teaching of engineering thinking to (mineral) process engineers. It brings together the approaches of mechanical engineering and the process laws of process engineering. The students learn to analyze how a unit-operation is set up in an apparatus. The module further introduces material laws of suspensions, wet and dry powders and particle beds. Auxiliary units like pumps, gas filters, mixing vessels and industrial waste water technology are introduced.
Contents	Design strategies • Design of apparatus / design of process • Analyze of unit operation and process equipment • Conceptual design • Functionality • New principles / parallelizing / serializing Material laws • Suspension Rheology • Solids Mechanics • Agglomerate durability • compression laws Auxiliary equipment • Mixing vessels • Gas cleaning by filters • Settlers • Liquid filters • Membranes
Teaching Methods	Lectures (2 semester week hours)
Assessment Methods	For the award of credit points it is necessary to pass the module exam, which contains: • oral exam (min. 30 minutes) or written exam (120 minutes, if 8 students or more)
Grading	The grade is generated from the examination result(s) with the following weights (w): • oral exam / written exam (1)
Materials/literature	to be announced
Workload	180 (attendance: 60 h; self-studies: 120 h)

Module Name	**Discrete Element Method**
ECTS Credits	**4**
Responsible	Rüdiger Schwarze, Prof. Dr.-Ing.

Lecturer(s)	Rüdiger Schwarze, Prof. Dr.-Ing.
Institute(s)	Institute of Mechanics and Fluid Dynamics
Duration	1 Semester (winter)
Teaching Language	English
Learning Outcome (Competencies)	Students should remember the fundamentals of the discrete element method. They should be able to distinguish the different numerical techniques and algorithms applied in the discrete element method. They should be able to apply the discrete element method to simple problems in the field of granular materials.
Contents	Most important ingredients are: • modeling strategy (conceptual and numerical model); • classification of DEM; • contact detection; interaction force-displacement laws, contact and friction laws; • algorithms for solving the equations of motion; • modelling of granular material; • introduction to simulation tools and software (Yade, LIGGHTS, etc.) • practical hints; applications; practical exercises in 2d and 3d.
Teaching Methods	Lectures (2 semester week hours) Exercises (1 semester week hour)
Pre-requisites	Recommendations: Fundamental of microstructures; continuum mechanics; introduction to scientific programming; fundamentals in mechanics
Assessment Methods	For the award of credit points it is necessary to pass the module exam, which contains: • oral exam (min. 30 minutes) or written exam (60 minutes, if 5 students or more)
Grading	The grade is generated from the examination result(s) with the following weights (w): • oral exam / written exam (1)
Materials/literature	Pöschel, T. & Schwager, T.: Computational Granular Dynamics, Springer Jing, L &Stephansson, O.: Fundamentals of Discrete Element Methods for Rock Engineering, Elsevier Matuttis, H.G. & Chen, J.: Understanding the Discrete Element Method, Wiley
Workload	120 (attendance: 45 h; self-studies: 75 h)

Module Name	**Maintenance Engineering**
ECTS Credits	**3**
Responsible	Holger Lieberwirth, Prof. Dr.-Ing.
Lecturer(s)	Holger Lieberwirth, Prof. Dr.-Ing.
Institute(s)	Institute of Mineral Processing Machines
Duration	1 Semester (winter)
Teaching Language	English
Learning Outcome (Competencies)	The students shall be enabled to understand maintenance as a complex of technical, technological, organizational and economic tasks and to plan the maintenance process within the framework of the production process control, to prepare it technologically and to implement it rationally, taking into account legal requirements.

Contents	- Content / Purpose / Tasks / Organization of maintenance - Damage processes, technical diagnostics, renewal processes - Maintenance methods - Planning of maintenance measures - Maintenance organization - Technology of maintenance - Reliability of technical systems - Maintenance-friendly design and configuration - Analysis of weak points of machines and plants
Teaching Methods	Lectures (2 semester week hours)
Assessment Methods	For the award of credit points it is necessary to pass the module exam, which contains: • oral exam (min. 30 minutes) or written exam (90 minutes, if 10 students or more)
Grading	The grade is generated from the examination result(s) with the following weights (w): • oral exam / written exam (1)
Materials/literature	Manzini, R., Regattieri A., Pham, H., Ferrari, E.: Maintenance of IndustrialSystems, Springer, 2010 DIN EN 13306:2010-12: Maintenance – Maintenance Terminology, Beuth, 2010
Workload	90 (attendance: 30 h; self-studies: 60 h); self-studies include the preparation and follow-up of the lectures as well as preparation for the examination.

Module Name	**Sustainable Engineering**
ECTS Credits	**4**
Responsible	Matthias Kröger, Prof. Dr.
Lecturer(s)	Matthias Kröger, Prof. Dr. Robert Szlosarek, Dr.
Institute(s)	Institute for Machine Elements, Engineering Design and Manufacturing
Duration	1 Semester (winter)
Teaching Language	English
Learning Outcome (Competencies)	The students are able to analyze the sustainability of developed machines based on life-time analyses. The students can design machines considering criteria for sustainable design, production and use of machines.
Contents	The module focuses on the following topics: • Analyses of product life cycle and carbon footprint • Assessment of machine design in respect to environmental impact, resource and energy consumption • Design for reuse and recycling of machines and components • Repair-friendly and durable engineering design • Machine design for the Third World • Examples of sustainable and not sustainable system design
Teaching Methods	Lectures (1 semester week hour) Exercises (2 semester week hours)
Pre-requisites	Recommendations: design of machine elements or components of machine and apparatures

Assessment Methods	For the award of credit points it is necessary to pass the module exam, which contains: • oral exam: 30 minutes
Grading	The grade is generated from the examination result(s) with the following weights (w): • written exam (1)
Materials/literature	Brundtland Report 1987. https://en.wikisource.org/wiki/Brundtland_Report
Workload	120 (attendance: 45 h; self-studies: 75 h)

Module Name	**Project - Process Design Mineral Processing / Recycling**
ECTS Credits	**8**
Responsible	Urs A. Peuker, Prof. Dr.-Ing.
Lecturer(s)	Research assistants at the Institute of Mechanical Process Engineering and Mineral Processing
Institute(s)	Institute of Mechanical Process Engineering and Mineral Processing
Duration	1 Semester (winter)
Teaching Language	English
Learning Outcome (Competencies)	The project work aims at the dimensioning of a mineral processing plant. On the basis of lab scale test (e.g. Bond grindability) the students work out a basic engineering of a processing plant of a given ore type / recycling question. The students learn to select the right lab scale tests, which provide the material and process data to quantify the individual processing steps. They learn the balancing of the material flows as well as of the auxiliary streams (e.g. process water).
Contents	Seminar: • Introduction into basic engineering • Plant layout • Example of a case study • Selection of lab scale tests / using standard parameters (e.g. VDI guidelines) • Documentation Project: • Selection of lab tests • Lab work: determination of individual parameters • Definition of interface between process steps • Selection of apparatus / dimensioning of process step • Presentation of flow sheet.
Teaching Methods	Seminar (2 semester week hours) Practical application(8 semester week hours)
Pre-requisites	Recommendations: Conception of process equipment; training in particle technology
Assessment Methods	For the award of credit points it is necessary to pass the module exam, which contains: • Report (basic engineering - process layout and applied engineering tools) • Presentation (determination of key parameters using engineering tools)

	• Presentation (process layout) All the above exams have to be passed or completed with at least 4.0.
Grading	The grade is generated from the examination result(s) with the following weights (w): • Report (basic engineering - process layout and applied engineering tools) [w: 2] • Presentation (determination of key parameters using engineering tools) [w: 1] • Presentation (process layout) [w: 1]
Materials/literature	selected papers and textbook chapters for individual project topic (to be announced in the first week) VDI guidelines and international standards
Workload	240 (attendance: 150 h; self-studies: 90 h)