BACHELOR OF SCIENCE IN RAW MATERIALS AND PROCESS ENGINEERING

MODULE HANDBOOK (1st – 8th semester)

CONTENTS

INTRODUCTION

Aims, Objectives, and Learning Outcomes of the First Cycle Degree Course "Raw Materials and Process Engineering" at the German-Mongolian Institute of Technology and Resources (GMIT)

The application oriented first cycle degree course "Raw Materials and Process Engineering" aims at providing knowledge, abilities and competencies in engineering, mathematics and natural sciences in order to enable the graduate to plan, control and operate machines and process chains for refining and processing raw materials and other products in economic, ecologic and sustainable ways.

Its objective is to qualify the graduate of the first cycle degree course "Raw Materials and Process Engineering" for an application oriented employment or entrepreneurship in the field of process engineering and for live long learning.

The principles of sustainability, safety and environmental protection are inherent in all study projects and other educational components. Throughout the studies the prospective engineers are educated in the spirit of responsibility towards the society, towards the economy, and towards the environment.

The graduates of the first cycle degree course "Raw Materials and Process Engineering" will be able to

- apply mathematical, scientific and engineering principles for solving problems of processing resources, raw materials and other products.
- recognise and analyse problems, develop engineering solutions to problems, and realize holistic solutions for them.
- assess and apply as engineers in design, development, production, distribution and consulting scientific methods in order to foster the progress both of the society and of process engineering.
- apply information science for solving resource processing problems.
- work in international teams in order to solve extensive and interdisciplinary problems.
- recognise the consequences of engineering activities in order to act responsibly within and for the society, the economy, and the environment.

STUDY PLAN

Raw Materials and Process Engineering: 2019/2020

CPs	1. Semester	2. Semester	3. Semester	4. Semester	5. Semester	6. Semester	7. Semester	8. Semester
1	Mathematics I 8 CP (4 UoIL, 4 UoIR)	Mathematics II 8 CP (4 UoIL, 4 UoIR)	Physics 8 CP (2 UoIL, 2 UoIR, 4 UoILab)	Measurement and Control 4 CP (2 UoIL, 1 UoIR, 1 UoILab)	Introduction to Mining 6 CP (3 UoIL, 1 UoIR, 1 UoIFt)	Mechanical Process Engineering II 6 CP (2 UoIL, 1 UoIR, 1 UoILab, 1UoIFt)	Chemical Reaction Engineering 4 CP (2 UoIL, 1 UoIR)	Bachelor Thesis + Colloquium 12 CP
2								
3								
4				Properties of Rocks 4 CP (2 UoIL, 2 UoIR)			Fossil Fuel Technology 4 CP (2 UoIL, 2 UoIR)	
5								
6								
7					Mechanical Process Engineering I 4 CP (1 UoIL, 1 UoIR, 1 UoILab)	Mining and Environment 4 CP (2 UoIL, 1 UoIR, 1 UoIFt)		
8								
9	Chemistry 6 CP (4 UoIL, 2 UoIR)	Materials Science 6 CP (2 UoIL, 2 UoIR; 2 UoILab)	Statistics and Numerics 4 CP (2 UoIL, 2 UoIR)	Fluid Mechanics 4 CP (2 UoIL, 2 UoIR)			Hydrometallurgy 6 CP (2 UoIL, 2 UoIR, 1 UoIL, 1 UoIFt)	
10								
11					Heat and Mass Transfer 4 CP (2 UoIL, 2UoIR)	Energy Systems 6 CP (2 UoIL, 1 UoIR, 1 UoIExc)		
12								
13			Engineering Thermodynamics 4 CP (2 UoIL, 2 UoIR)	Scientific Methods 2 CP (2 UoIR)				Process Systems Engineering 8 CP (3 UoIL, 2 UoIR, 1 UoILab)
14								
15	Engineering Mechanics I (Statics) 5 CP (2 UoIL, 2 UoIR)	Chemistry: Laboratory 4 CP (4 UoILab)		CAD 4 CP (1 UoIL, 3 UoILab	Raw Materials and Recycling 4 CP (2 UoIL, 1 UoIR)	Industrial Internship + Reflection 14 CP 14 Weeks	Thermal Unit Operations 6 CP (2 UoIL,1UoIR, 2 UoILab)	
16								
17			Engineering Design 4 CP (2 UoIL, 2 UoIR)					
18								
19		Engineering Mechanics II (Dynamics) 4 CP (2 UoIL, 2 UoIR)		Engineering Mechanics III (Mechanics of Materials) 4 CP (2 UoL, 2 UoR)	Health-Safety-Environment 4 CP (2 UoIL, 1 UoIR, 1 UoIFt)		Scientific Writing 4 CP (2 UoIR)	Final Study Project 6 CP (2 weeks + report + presentation + excursion)
20	Introduction to Computer Science 4 CP (1 UoIL, 3 UoIL)		Introduction to Electrical Engineering 4 CP (2 UoIL, 2 UoIR)					
21								
22					Electives 3 CP			
23		Introduction to Geosciences 4 CP (2 UoIL, 2 UoIR)		Thermodynamics for Chemical Engineering 4 CP (2 UoIL, 2 UoIR)				
24	Intercultural Communication and Competence 2 CP (2 UoIL)						Electives 3 CP	
25			Introduction to Economics 4 CP (2 UoIL, 2 UoIR)		Electives 3 CP			
26	Engineering Project (1 week) 2 CP							
27		Technical English 3 CP (4 UoIR)		Engineer in Society 4 CP (2 UoIL, 2 UoIR)			Electives 3 CP	
28	Electives 3 CP				Electives 3 CP			
29			Electives 3 CP					
30		Electives 3 CP						
31								
32								
CP total per semester	30	32	31	30	31	30	30	26
Contact hours (60 min.)								
Contact hours (60 min.)								

Legend:	CP =	Credit Points	Fundamentals	Specialisation	Electives	General	Foreign Languages	Internship /Project/ Thesis
	UoI =	Unit of Instruction (45 min. per unit)			Electives listed in the Module handbook		Entrance req. English: B2 goal 1.Sem: C1	
	UoIL =	Unit of Instruction Lecture			other engineering subjects offered by other programs		2. Sem: Technical English (obligatory)	
	UoIR =	Unit of Instruction Recitation						
	UoILab =	Unit of Instruction Laboratory						
	UoIFt =	Unit of Instruction Field trip						

PROJ140 – ENGINEERING PROJECT

Module title	Engineering Project				**Module-Code**	PROJ140
Duration	1 week + report	**Semester**	Fall Semester		**Module-Start**	1
Credit points	2 CP	**Workload**	60 h	**Contact hours**		44 h
				Individual study		16 h
Module coordinator	Prof. N. Battulga			**Language**	English	

Syllabus	During the project, students work in small groups on an interdisciplinary assignment. Each student contributes to producing an interdisciplinary solution by working as a team with the resources from their individual disciplinary perspectives. The students of mechanical engineering experience the way an engineer deals with problems, they construct in methodology way and solve complex engineering tasks. The assignment is given out at the beginning of the project. Trained support staff accompanies the groups during the course of the project and encourages the development of social and subject-related skills.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Produce a goal-oriented solution through interdisciplinary teamwork. 2. Comprehend and work on an interdisciplinary assignment using design principles of mechanical engineering. 3. Moderate team processes. 4. Plan, organize and carry out tasks independently. 5. Discuss possible solutions and to reach a decision that is guided by criteria 6. Acquire competence in applying scientific methods and to analyse different problems of a task 7. Present different results to an auditorium and to discuss them respectively 8. Reflect scientific acting and assess its societal consequences
Literature	Script
Form of teaching	Project course
Assessment methods	Successful participation, group presentation, poster, report
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering

Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	Pass/fail

MATH110 – MATHEMATICS I

<table>
<tr><td>Module title</td><td colspan="3">Mathematics I</td><td colspan="2">Module-Code</td><td>MATH110</td></tr>
<tr><td>Duration</td><td>1 semester</td><td>Semester</td><td>Fall Semester</td><td colspan="2">Module-Start</td><td>1</td></tr>
<tr><td rowspan="2">Credit points</td><td rowspan="2">8 CP</td><td rowspan="2">Workload</td><td rowspan="2">240 h</td><td colspan="2">Contact hours</td><td>96 h</td></tr>
<tr><td colspan="2">Individual study</td><td>144 h</td></tr>
<tr><td>Module coordinator</td><td colspan="3">Prof. L. Altangerel</td><td>Language</td><td colspan="2">English</td></tr>
<tr><td>Syllabus</td><td colspan="6">• Basics: logic, sets, functions and number sets (real and complex numbers)
• Basic linear algebra: matrices, determinants, systems of linear equations, eigenvalue problems, vector spaces, linear maps
• Analysis of functions of a single variable: series and functions, limits and continuity, differentiation and integration
• Series: numerical series, function series, power series</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">On successful completion of this module, the students should be able to:
1. Describe and explain basic mathematical topics and methods.
2. Demonstrate and apply the basic principles of linear algebra.
3. Demonstrate and apply the basic concepts of analysis of a single variable.
4. Examine mathematical models to represent and solve simple scientific and engineering problems.</td></tr>
<tr><td>Literature</td><td colspan="6">Anton, H. and Rorres, C. (2014) Elementary linear algebra, 11th edition, Wiley
Kenneth, J.R. (2007) Discrete mathematics and its applications, 7th edition, McGraw-Hill Education
Stewart, J. (2008) Calculus: Early Transcendentals, 6th edition, Brooks Cole
Thomas' calculus (2016), 13th edition, Pearson Education</td></tr>
</table>

	Tobias, M.J. and Krantz, S. (2011) *Matrices in engineering problems*.
Form of teaching	Lecture (4 UoI) Recitation (4 UoI)
Assessment methods	Written examination (180 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

CHEM110 – CHEMISTRY

Module title	Chemistry			**Module-Code**	CHEM110
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	1
Credit points	6 CP	**Workload**	180 h	**Contact hours**	72 h
				Individual study	108 h
Module coordinator	Prof. B.Battsengel			**Language**	English
Syllabus	The students will be given an introduction to chemistry and familiarised with the basic principles and concepts of organic, inorganic and physical chemistry • Material data acquisition; safety technology • Systems, materials, elements, compounds • Aggregate states, structures, elementary particles • Masses and quantities, stoichiometry • Atomic structure and the Periodic System of elements • Chemical bond: covalence • Chemical bond: metals and ion crystal • Oxidation number: intermolecular exchange effects • State behaviour and the Gas Laws • Thermodynamics: basics, entropy, Gibbs free energy				

	• Chemical reaction and chemical equilibrium • Acids and bases: basics • Acid-base reactions • Kinetic chemical reactions • Redox chemistry: basics • Redox chemistry: electrochemistry, batteries, corrosion • Chemistry of the main group elements and d-metal, Complex formation • Introduction to organic chemistry • Polymer chemistry • Nuclear chemistry
Learning outcomes	On successful completion of this module, the students should be able to: 1. Determine physical and safety-related data for materials, and interpret it in context. 2. Apply chemical nomenclature to simple compounds. 3. Carry out the stoichiometric calculations. 4. Explain and apply the atomic structure of chemical elements and chemical bonds of molecules. 5. Apply the law of mass action to the chemical equilibrium systems. 6. Describe and solve the kinetics of chemical reactions and interpret experiments on the kinetics of reactions. 7. Apply the basic concepts of analytical chemistry in chemical analysis 8. Balance redox reactions, interpret and design electrochemical reactions. 9. Explain and apply the chemical elements in the main periodic groups and d-metals 10. Apply the acquired basic definitions of thermodynamics in thermodynamic systems. 11. Interpret and apply the basic concepts of nuclear chemistry and explain the nuclear reactions. 12. Describe the structure and synthesis of polymers and interpret the properties of polymers, apply the acquired knowledge, solve the problems 13. Explain basic chemical concepts and models, and analyse, interpret and apply them. Solve the general chemical problems.
Literature	Atkins, P. and Jones, L. (2013) *Chemical principles*, 6th edition, W.H.Freeman Brown, L.S. and Holme, T. (2011) *Chemistry for Engineering Students*, 2nd edition, Cengage Learning Silberberg, M. *Chemistry - Molecular Nature of Matter and Change,* 6th edition, McGraw-Hill Education
Form of teaching	Lecture (4 UoI) Recitation (2 UoI)

Assessment methods	Written examination (120 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

MECH120 – ENGINEERING MECHANICS I (STATICS)

Module title	Engineering Mechanics I (Statics)			**Module-Code**	MECH120
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	1
Credit points	5 CP	**Workload**	150 h	**Contact hours**	48 h
				Individual study	102 h
Module coordinator	Prof. Sungchil Lee			**Language**	English

Syllabus	Definition of force, general systems of forces and equilibrium of rigid bodies, centre of mass, reaction of the supports, statically determined system, trusses, beams, frames, curved beams, work principles, stability and friction.
Learning outcomes	On successful completion of this module, the students should be able to: 1. discern and explain the concept of force, moment and equilibrium. 2. analyse statically determinate problems independently, i.e. to identify the forces, and determine their attack points and effects and formulate equilibrium conditions. 3. ascertain the support reactions in statically determinate systems by means of equilibrium conditions or the principle of virtual work. 4. compute internal forces and moments in beams and trusses. 5. determine the equilibrium positions of a given movable system and investigate their stability. 6. determine the equilibrium positions of a given movable system and investigate their stability. 7. analyse static systems including static or kinetic frictions and calculate corresponding forces. 8. analyse statically determined and statically undetermined systems of bars.
Literature	Meriam, J. L. and Kraige, L. G. (2013) Engineering Mechanics. Statics, 7th edition, Wiley India Gross, D., Hauger, W. , Schröder, J., Wall, W.A. and Rajapakse, N. (2009) Engineering Mechanics 1. Statics, Springer-Verlag
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment methods	Written examination (120 min.) and academic performance.
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering

	B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

INFO110 – INTRODUCTION TO COMPUTER SCIENCE

Module title	Introduction to Computer Science			**Module-Code**	INFO110
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	1
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Dr. Ch.Oyuntungalag			**Language**	English
Syllabus	This course comprises the following topics: • MATLAB introduction and environment • Variables, data types and operators • Vectors and matrices • Selection statements • Loop statements • Script and function • Plotting and colour maps • String manipulation • Data structures • File input/output • GUI introduction				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Become familiar with MATLAB environment 2. Understand the fundamentals of programming 3. Manipulate vectors, matrices and strings 4. Use built-in commands and mathematical functions to make calculation 5. Solve simple problems using selection and loop statements				

	6. Create and call user-defined functions 7. Draw various types of graphics 8. Design and contsruct data structures when required 9. Read/write data from/to files to manipulate 10. Develop program with simple GUI
Literature	Stormy Attaway (2013) *MATLAB: A practical Introduction to Programming and Problem Solving*, 3rd Ed., Elsevier Craig S. Lent (2013) *Learning to program with MATLAB*, 1st Ed., Wiley
Form of teaching	Lecture (1 UoI) Recitation (1 UoI)
Assessment methods	Written examination (120 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

INCC100 – INTERCULTURAL COMMUNICATION AND COMPETENCE

Module title	Introduction to Intercultural Communication and Competence			**Module-Code**	INCC100
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	1
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	John Nixon			**Language**	English
Syllabus	Participants in this course • learn about potential intercultural misunderstandings by examining critical incidents • reflect on their own cultural background and values • are introduced to several models of intercultural communication and competence, including those of E.T. Hall, G. Hofstede, *World Values Survey* • can apply these models in interactive communicative tasks based on examination of critical incidents • learn how to work effectively on intercultural teams in order to set goals, establish strategies and solve problems				
Learning outcomes	On successful completion of this module, the students should be able to: 1. recognize and identify important cultural differences. 2. cope with sensitive cultural idiosyncrasies effectively and respond to these differences in an appropriate and tactful manner. 3. understand their own cultural background and values. 4. examine various intercultural models and apply them to critical incidents. 5. evaluate and classify other cultural behavioral and communication characteristics. 6. apply effective intercultural argumentation and communication strategies. 7. behave in a culturally appropriate manner in business and daily situations in English. 8. analyze intercultural incidents and apply problem-solving strategies. 9. work effectively on intercultural teams.				

Literature	Bennett, M. (1998). *Basic Concepts of Intercultural Communication: Selected Readings,* Intercultural Press, Inc. Glaser, Guilherme, Mughan (2007). *Intercultural Competence for Professional Mobility*, Council of Europe Press.
Form of teaching	Recitation (2 UoI)
Assessment methods	Presentation, discussions, final exam (30% performance, 70% exam)
Associated study programme	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	B2 level of English
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

MATH111 – MATHEMATICS II

Module title	Mathematics II				**Module-Code**	Math111
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	2
Credit points	8 CP	**Workload**	240 h	**Contact hours**		96 h
				Individual study		144 h
Module coordinator	Prof.L.Altangerel			**Language**	English	

Syllabus	• Fourier series and Fourier transform. • Differential calculus of functions of several variables: convergence and continuity, partial derivatives, total differentiability, extreme value problems • Line integrals, integration over regions, surface integrals and volumetric integrals • Modelling using differential equations, first and second order ordinary differential equations.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain and calculate differential and integral calculus of functions of several variables and the theory of ordinary differential equations. Be aware of their connections and potential applications in other fields. 2. Make use of mathematical models to solve complex scientific and engineering problems.
Literature	Kreyszig, E. (2011) *Advanced Engineering Mathematics: International student version*, Laurie Rosatone Stewart, J. (2008) *Calculus: Early Transcendentals*, 6th edition. *Thomas' calculus* (2016), 13th edition, Pearson Education
Form of teaching	Lecture (4 UoI) Recitation (4 UoI)
Assessment methods	Written examination (180 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Completion of *Mathematics I* recommended.

Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

MATS120 – MATERIALS SCIENCE

Module title	Materials Science			**Module-Code**	MATS120
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	2
Credit points	6 CP	**Workload**	180 h	**Contact hours**	72 h
				Individual study	108 h
Module coordinator	Prof. L.Altangerel			**Language**	English
Syllabus	Material properties, destructive and non-destructive test procedures (material testing technology), structure and mechanical properties of solid bodies, thermally activated processes, binary phase equilibrium, phase changes, Fe-C alloys, states of non-equilibrium, heat treatment processes and the resulting changes in properties, and experimental consolidation of theory in selected fields.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. describe the connection between atomic structure, thermally activated processes, states of phase equilibrium and non-equilibrium, and macroscopic properties using the example of metallic materials. 2. explain the significance of the main mechanical properties in relation to component design. 3. explain the fundamentals of non-destructive testing. 4. select materials in a responsible manner 5. recognise and apply the significant properties for mechanically characterising materials. On successful completion of the practical laboratory work, the students should be able to: 1. prepare experiments using written instructions. 2. carry out experiments unaided, in teams and under partial instruction. 3. present the results of the experiment in an appropriate manner.				

Literature	Shakelford, J.F. (2015) *Introduction to materials science for engineers,* 11th edition. Anderson, J.C. and Leaver K.D. (1990) *Material science* ,4th edition. Callister, W.D. and Rethwish, D.G. (1990) *Materials Science and Engineering*, 9th edition.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI) Laboratory (2 UoI)
Assessment methods	Written examination (120 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Knowledge of the modules Chemistry and Engineering Mechanics I (Statics)
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

CHEM111 – CHEMISTRY LABORATORY

Module title	Chemistry Laboratory			**Module-Code**	CHEM111
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	2
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. B.Battsengel			**Language**	English

Syllabus	Selected experiments in the fields of general chemistry, analytical chemistry and electrochemistry: unaided acquisition of knowledge, colloquia and written reports. <u>Laboratory practical work</u> • Systems, Compounds, Elements, and Chemical Bonds: Properties of mixture • Properties of matter - boiling point • Reaction of magnesium and calcium with water – hydroxide • Quantitative analysis of oxides • Formation of salts by reaction of metals with acids • Water molecules – dipoles • Production of metal alloys • Electrical conductivity of solutions of salts • Reduction - reducing agents - redox process • Basics of Acids and Bases: Detection of acidic reaction with various indicators • Determination of pH values and calibration of pH-electrodes • Neutralization of hydrochloric acid with caustic soda solution • Titration curves and buffering capacity with Cobra4 • Electrolysis of hydrochloric acid • Secondary cells - the lead accumulator
Learning outcomes	On successful completion of this module, the students should be able to: 1. apply simple working procedures in the laboratory. 2. use experimental equipments in accordance with the safety regulations, and carry out experiments. 3. work together in small groups. 4. prepare a technical report on an experiment and present the results of the experiment in a suitable form. 5. use technical terms and expressions in English.
Literature	Atkins, P. and Jones, L. (2013) *Chemical principles*. 6th edition. W.H.Freeman Beran, J.A. (2014) *Laboratory Manual for Principles of General Chemistry*, Wiley

	Brown, L.S. and Holme, T. (2011) *Chemistry for Engineering Students*, 2nd edition, McGraw-Hill Education
Form of teaching	Laboratory (4 UoI)
Assessment methods	Pre lab questions before conducting lab experiments, and post lab defence and written documentation (lab reports) after the experiment. Midterm exams after completing 5 modules each.
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the lab performance (including prelab, participation on experiments and lab report defence) during the module accounting for 70% and the the final examination accounting for 30%

MECH121 – ENGINEERING MECHANICS II (DYNAMICS)

Module title	Engineering Mechanics II (Dynamics)				**Module-Code**	MECH121
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	2
Credit points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module coordinator	Prof. Sungchil Lee			**Language**	English	
Syllabus	Kinematics of points and rigid bodies, relative kinematics, kinetics of rigid bodies, work and energy, vibrations, impact, principles of mechanics (d'Alembert's principle, Lagrange's equations).					
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe planar and spatial motions of point masses and rigid bodies. 2. Analyse dynamical problems and to derive the equations of motion for simple mechanical systems. 3. Apply Newton´s and Euler´s laws in order to solve dynamical problems. 4. Model simple vibration systems and to solve simple differential equations. 5. Apply the principles of mechanics to simple problems.					
Literature	Meriam, J. L. and Kreige, L.G. (2013) *Engineering Mechanics. Dynamics,* 7th edition, Wiley India					
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)					
Assessment methods	Written examination (90 min.) and academic performance					
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering					
Prerequisites for participation	Mathematics I, Engineering Mechanics I (Statics) recommended					
Requirements for receiving credit points	Passing the module					

Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

GEOS120 – INTRODUCTION TO GEOSCIENCES

Module title	Introduction to Geosciences			**Module-Code**	GEOS120
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	2
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. D. Karthe			**Language**	English
Syllabus	• Earth Materials Crystal forms, chemical and physical properties of minerals, classification of minerals; systematic mineralogy of selected native elements, hydroxides and halides, silicates, carbonates, oxides and sulphides; applied mineralogy of ore and industrial minerals and gems; environmental properties of minerals; determination of minerals using simple aids. Earth Processes • Earth's structure; endogenous processes (plutonism, volcanism, metamorphism; plate tectonics); exogenous processes (erosion, sedimentation); determination of rocks using simple aids (hand specimen of magmatic, metamorphic and sedimentary rocks). Earth Resources • Earth's structure; endogenous processes (plutonism, volcanism, metamorphism; plate tectonics); exogenous processes (erosion, sedimentation); determination of rocks using simple aids (hand specimen of magmatic, metamorphic and sedimentary rocks). • Earth Resources Origin of, prospecting for, and extraction of mineral raw materials, global distribution of ore deposits, endogenous and exogenous ore forming processes, classification of ore deposit types, plate-tectonic control on ore deposits formation, properties and uses of common ore and industrial minerals, and volume commodities, economic significance of mineral raw materials to the national economy, introduction to economic, technical and ecological aspects of raw materials extraction with respect to the sustainable use of geological resources; determination of ore samples using simple aids (small hand specimen of metallic and non-metallic ores). • Earth's climate and soil Fundamentals of the global atmospheric circulation system, climate parameters; distribution of solar insolation and orbital parameters; its influence on the distribution of climate and ecological zones. Brief climate history of the Earth Principles of soil formation and pedogenic processes and soil types; the role of soils as a boundary between atmosphere and lithosphere and as part of ecological systems and land use.				
Learning outcomes	I. Earth Materials				

	On successful completion of this module, the students should be able to: 1. Identify the crystallographic and physical-chemical properties of minerals. 2. Classify minerals into crystallographic and chemical classes. 3. Identify the salient properties (chemical formula, crystal form, Moh's hardness, density, colour, cleavage and fracture) of native elements, hydroxide and halide, silicate, carbonate, oxide and sulphide minerals. 4. Identify the industrial uses and environmental properties of the metallic and non-metallic ores and gemstones. 5. Identify important minerals and know their respective chemical formulae. II. Earth Processes On successful completion of this module, the students should be able to: 1. Recall the shell structure of the Earth and plate-tectonic processes. 2. Differentiate between the structures of the Earth's oceanic and continental crust. 3. Recall the processes of plutonic, volcanic and metamorphic rock formation. 4. Recognise important rock types and describe their mineral composition and structure. III. Earth Resources On successful completion of this module, the students should be able to: 1. Classify ore deposits into groups of metallic and non-metallic raw materials and recall the different types of ore deposits. 2. Recall the processes of endogenous and exogenous ore deposit formation in the context of plate tectonics. 3. Recall the global distribution of ore deposits of the various raw materials. 4. Recall the properties and uses of the main ores and industrial minerals and volume commodities. 5. Recall the economic, technical and ecological aspects of the extraction of raw materials. 6. Summarise terms measures for the sustainable use of Earth resources in qualitative terms. 7. Recognise relevant ore samples and describe their mineral composition and structure. IV. Earth's climate and soils On successful completion of this module, the students should be able to: 1. Describe and differentiate the distribution of basic soil types on Earth 2. Recall the fundamentals of the global atmospheric circulation system and orbital parameters

	3. Recall and identify the basic processes of pedogenesis 4. Summarise the distribution of climate and ecological zones on Earth 5. Evaluate the role of soils in context of ecology and land use
Literature	Klein, C. and Philpotts (2012) *Earth Materials: Introduction to Mineralogy and Petrology*. Wenk, H.-R. and Bulakh, A. (2004) *Minerals :Their Constitution and Origin*. Mukherjee, S (2011) *Applied Mineralogy Applications in Industry and Environment.* Grotzinger, J., Jordan, T.H., Press, F. and Siever,R. (2010) *Understanding Earth*. 6th edition. Hamblin, W.K. (2004) *Earth's dynamic systems*. Evans (1993) *Ore geology and industrial minerals*.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment methods	Written examination (90 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

ENGL100 – TECHNICAL ENGLISH

Module title	Technical English				**Module-Code**	ENGL100
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	2
Credit points	3 CP	**Workload**	90 h	**Contact hours**		48 h
				Individual study		42 h
Module coordinator	Dr. Simon Kim			**Language**	English	

Syllabus	This modules provides an overview of various subjects related to technical English with a particular focus on engineering and the natural sciences. Topics include properties of materials, energy and power generation, tools, forces, environmental issues and mining.
Learning outcomes	On successful completion of this module, the students should be able to: 1. identify the core meaning of and understand the details of technical and scientific texts from a variety of disciplines; 2. follow and grasp the main points illustrated in audio and video material related to different areas of science and technology. 3. examine and identify lexical, morpho-syntactic and stylistic structures typical of technical English. 4. write a variety of scientific and technical texts, e.g. lab reports, technical summaries, instructions of use; feasibility assessments. 5. assess their own pieces of writing in order to further improve their writing skills in a scientific context. 6. deliver a scientific presentation using appropriate signposting. 7. respond effectively to questions related to their scientific presentations and texts. 8. contribute to academic discussions on a variety of subjects related to science and technology. 9. compile a list of vocabulary and collocations related to their area of specialization.
Literature	Amling, Barbara et al. (2011) *English for Mechanical Engineers. Coursebook* , Cornelsen
Form of teaching	Recitation (4 UoI)
Assessment methods	Written examination (120 minutes), in-class oral examination (15 minutes), academic performance during the semester

Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	English C1 level
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

PHYS210 – PHYSICS

<table>
<tr><td>Module title</td><td colspan="3">Physics</td><td colspan="2">Module-Code</td><td>PHYS210</td></tr>
<tr><td>Duration</td><td>1 semester</td><td>Semester</td><td>Fall Semester</td><td colspan="2">Module-Start</td><td>3</td></tr>
<tr><td rowspan="2">Credit points</td><td rowspan="2">8 CP</td><td rowspan="2">Workload</td><td rowspan="2">240 h</td><td colspan="2">Contact hours</td><td>96 h</td></tr>
<tr><td colspan="2">Individual study</td><td>144 h</td></tr>
<tr><td>Module coordinator</td><td colspan="3">Prof. N.Battulga</td><td>Language</td><td colspan="2">English</td></tr>
<tr><td>Syllabus</td><td colspan="6">Oscillations
• Damped and forced oscillations in mechanical and electrical systems
• Wave propagation: mechanical and light waves
• Superposition of waves, standing waves and resonance
• Coupled oscillations
Waves
• Wave phenomena, Fourier decomposition
• Dispersion relation, phase and group speed
• Wave phenomena: breaking, interference and bending
• Doppler effect, electromagnetic waves
Optics
• Geometric optics, beam optics, optical instruments
• Light sources (thermal emitters, gas dischargers, LEDs, lasers)
• Spectroscopy
Atomic and nuclear physics
• Bohr’s model of the atom, radioactivity</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">On successful completion of this module, the students should be able to:
1. describe the characteristic features and properties of oscillations and waves, and identify these features by means of different systems.
2. apply the relevant physical laws that describe oscillations and waves in various problems.
3. describe characteristic wave phenomena and identify them in a variety of systems.
4. describe the principles of geometrical optics and their application in optical instruments, and apply these principles to the design of simple optical components.
5. describe and apply the main methods of measurement and analysis in the fields of mechanics, oscillations and waves, electromagnetism and optics.</td></tr>
</table>

	6. describe the basic principles of data recording, evaluation and interpretation, and apply them to experimental physical problems.
Literature	Freedman, Y. *University Physics with Modern Physics,* 13th edition. Crawford, F.S. *Waves and oscillations.* Fitzpatrick, R. *Oscillations and Waves: An Introduction.* Hecht, E. *Optics.* Hecht, E. *Schaum's Outline of Optics* Bennett, C.A. *Principles of Physical Optics.*
Form of teaching	Lecture (2 UoI) Recitation (2 UoI) Laboratory (4 UoI)
Assessment methods	Written examination (150 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B. Sc. Industrial Engineering
Prerequisites for participation	Passing the module „Physics laboratory" is a prerequisite for the participation of the final module examination
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

STAT210 – STATISTICS AND NUMERIC

Module title	Statistics and Numeric				**Module-Code**	STAT210
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	3
Credit points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module coordinator	Prof. L.Altangerel			**Language**	English	

Syllabus	Statistics: Sampling and descriptive statistics, basic probability concepts, random variables and probability distributions, parameter estimation and model verification. Numerical Methods: solving systems of linear and nonlinear equations, least-squares problems, numerical differentiation and integration, interpolation and quadrature methods for ordinary differential equations.
Learning outcomes	On successful completion of this module, the students should be able to: 1. identify models with random variables in engineering, select suitable methods of solution, and carry out simple probability calculations unaided. 2. analyse correctly analyse and evaluate statistical data. 3. apply the basic concepts of numerical methods (such as discretization, linearization and numerical stability). 4. select correctly select and apply simple numerical procedures to mathematical problems in engineering.
Literature	Navidi, W. (2008) *Statistics for engineers and scientists*, 3rd edition. Ott, R.L. and Longnecker, M. (2010) *An introduction to statistical methods and data analysis*, 6th edition. Walpole, R.E. (2012) *Probability and statistics for engineers and scientists*, 9th edition. Chapra, S.C. and Canale, R.P. (2010) *Numerical methods for engineers*, 6th edition. Kiusalaas, J. (2005) *Numerical methods in engineering with MATLAB*.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment methods	Written examination (180 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering

	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Mathematics II recommended.
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

THER220 – ENGINEERING THERMODYNAMICS

Module title	Engineering Thermodynamics			**Module-Code**	THER220
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	3
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. B. Battsengel			**Language**	English

Syllabus	Fundamental terms of thermodynamics; thermodynamic equilibrium and temperature; different forms of energy (internal energy, heat, work, enthalpy); properties and equations of state for gases and incompressible substances; first law of thermodynamics and energy balances for technical systems; second law of thermodynamics and entropy balances for technical systems; exergy analysis; thermo-dynamics of phase changes; the Carnot cycle for power generation or refrigeration; energy efficiency and coefficient of performance; cyclic processes for gas turbines, combustion engines, power plants, refrigerators and heat pumps.
Learning outcomes	On successful completion of this module, the students should be able to: 1. explain the relationships between thermodynamic properties and the thermodynamic state of a system, and apply them in calculating a thermal system behaviour. 2. distinguish between different types of energy (e.g. work, heat, internal energy and enthalpy) and define them. 3. analyse technical systems and processes using energy balances and equations of state. 4. assess energy conversion processes by means of an exergy analysis. 5. characterise the thermal behaviour of gases, liquids and solids, and corresponding phase change processes. 6. apply this basic knowledge (1.-5.) to examine machines (turbines, pumps etc.) and processes for energy conversion (combustion engines, power plants, refrigerators, heat pumps).
Literature	Cengel, Y. and Boles, M. (2014) *Thermodynamics: An Engineering Approach*, 7th edition. Koretsky, M.D. (2012) *Engineering and Chemical Thermodynamics*, 2nd edition.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)

Assessment methods	Written examination (90 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

DESN220 – ENGINEERING DESIGN

Module title	Engineering Design				**Module-Code**	DESN220
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	3
Credit points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module coordinator	E.Baljinnyam			**Language**	English	

Syllabus	The module will deal with the principles of product development and their representation in technical terms, and with selected aspects of the geometrical representation: elements of product design and development, different types of notation, multi-plane projections, cutaways and developed views, introduction to standardisation, tolerances, limits and fits, basics of design for batch production.
Learning outcomes	On successful completion of this module, the students should be able to: 1. interpret and assess basic technical relationships. 2. describe simple technical objects and represent them in a drawing. 3. explain the principles of technical construction (tolerances, limits and fits, spring elements, etc.), and apply them to the development and construction of components.
Literature	Gieseke et. al.: *Technical Drawing with Engineering Graphics,* International Edition, 14th edition. Mott et. al.: *Machine Elements in Mechanical Design,* 4th edition.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment methods	Written examination (120 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module

Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

ELEC220 – INTRODUCTION TO ELECTRICAL ENGINEERING

Module title	Introduction to Electrical Engineering				**Module-Code**	ELEC220
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	3
Credit points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module coordinator	Prof. P.Ariunbolor			**Language**	English	

Syllabus	Electrical charge, electrical current, electrical voltage and power, linear DC circuits, Ohm's law, Kirchhoff rules, ideal and real sources, electrical field, capacitor, electrostatic forces, capacitors in linear networks, magnetic field, Lorentz force, Ohm's law of the magnetic network, Ampere's circuital law, ferromagnetism, induction, selfinductance, inductors in linear networks, basic of electric machines and electric safety and power supply system.
Learning outcomes	On successful completion of this module, the students should be able to: 1. use electrical quantities and units. 2. calculate linear DC circuits. 3. calculate work, power, and energy. 4. analyse and calculate simple linear AC circuits. 5. design simple electronic circuits 6. apply the knowledge of electric safety.
Literature	Cathey J.J. and Nasar, S.A. (1984) *Basic Electrical Engineering*, McCraw-Hill Education Theraja B.L. and Theraja A.K. (2005) *A textbook of electrical technology*, Volume I Basic Electrical Engineering In S.I. System Of Units, S. Chand & Company Ltd., New Delhi, India
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment methods	Written examination (90 min.) and oral examination for documentation and presentation (10-30 min. per each students)
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Completion of Mathematics I is recommended.

Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

ECON200 – INTRODUCTION TO ECONOMICS

Module title	Introduction to Economics			**Module-Code**	ECON200
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	3
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	TBD			**Language**	English
Syllabus	This modules provides: • Introduction: What is economics, Economic Problem • How market works: Demand and Supply, Market Equilibrium, Elasticity, Markets in Action • Firms and Markets: Organizing Production, Output and Costs, Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly • Factor Markets: Markets for factors of production such as labour market and capital market				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain big questions of economics and key ideas that define the economic way of thinking; 2. Describe a competitive market, explain the influences on demand and supply, explain how demand and supply determine market equilibrium. 3. Calculate and explain the factors that influences the elasticities of demand and supply. 4. Explain what a firm is and describe the economic problems that all firms face, describe and distinguish between different types of markets in which firm operates. 5. Explain the relationship between a firm's output and labor employed in the short run, explain the relationship between a firm's output and costs in the short run and derive a firm's short-run cost curves, and explain the relationship between a firm's output and costs in the long run and derive a firm's long-run average. 6. Define perfect competition, monopoly, monopolistic competition and oligopoly, explain how firms make their supply decisions in these markets, and why perfect competition is efficient and why others are inefficient. 7. Explain the link between a factor price and factor income, explain what determines demand, supply, the wage rate, and employment in a competitive labor market, and explain what determines demand, supply, the interest rate, saving, and investment in the capital market.				

Literature	Atkinson, B. and Miller, R. (1998) *Business Economics*. Parkin M. (2016), *Economics, 12th edition* N.Gregory Mankiw*, Princilpes of Economics, 7th edition*
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment methods	Written examination (90 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

MEAS220 – MEASUREMENT AND CONTROL

Module title	Measurement and Control				**Module-Code**	MEAS220
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	4
Credit points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module coordinator	Prof. P.Ariunbolor			**Language**	English	
Syllabus	Measurement technology: physical significance, measuring arrangement, measurement chain, errors, the main procedures for measuring temperature, pressure, flow and filling levels Data-processing technology: measuring transducers, measured value boards (hardware), measurement software, processing and analysis programmes Regulator technology: product-integrated regulators, autonomous regulators (industry standard regulators), compact regulator stations, programmable regulator stations Process control technology: signal/packet-based data transmission, bus systems, transmission paths, coupling stations, engineering stations, software process manager, MES, ERP					
Learning outcomes	On successful completion of this module, the students should be able to: 1. Demonstrate the physical principles of measurement and recognise the process relationships in specific application examples. 2. Describe the digital processing of measurements. 3. Describe the operating method of control and regulating equipment, and set up the parameters of these devices. 4. Assess the options for optimising automation equipment and evaluate existing automation systems.					
Literature	Cain, M.C., Tesar, J. and Veghel, M. *Springer Series in Measurement Science and Technology.* Rossi, G.B. (2014) *Probabilistic Theory of Measurement with Applications*. Hebra, A. (2010) *The Physics of Metrology*. *Physical and Chemical Metrology Impact and Analysis* (2002) ASQ Quality Press. Pennella, C.R. (1997) *Managing the Metrology Systems*, ASQ Quality Press.					

Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI)
Assessment methods	Written (90 min.) and oral (30 min.) examination and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Completion of *Introduction to Electrical Engineering*, *Mathematics* I and II and *Physics* recommended.
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

ROCK220 – PROPERTIES OF ROCK

Module title	Properties of Rock			**Module-Code**	ROCK220
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	4
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. P.Vossen			**Language**	English
Syllabus	Mechanical properties of rock: formation and types of soft and hard rocks, in terms of dependent and independent properties, grain distribution, consistency limits, classification of soft rocks, dynamic compression tests, grain structure, total, effective and neutral stresses, deformation characteristics of linear isotropic elasticity theory, compressibility and time effects in oedometer tests, constrained modulus, effective and apparent shear strength, simplified triaxial test, biaxial test, true triaxial test, determination of deformation properties and shear strength in the triaxial test, determination of shear strength in a shear-load machine, hydraulic properties of soft rocks. Further properties of rocks will be described (density, water content, sources, hardness, abrasiveness), description of the testing techniques for hard rocks (hydro-thermo-mechanically coupled tests, non-destructive testing techniques, content/syllabus of current testing regulations and standards) The students will carry out standard laboratory tests without assistance, and evaluate the results.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. demonstrate a basic knowledge of geotechnical engineering in terms of the mechanical properties of soft rocks. 2. describe the main mechanical and thermo-hydro-mechanical properties of rocks. 3. determine these properties in the Rock and Soil Mechanics laboratory.				
Literature	*International Journal of Rock Mechanics and Mining Sciences,* Elsevier Verruijt, A. (2012) *Soil Mechanics,* Delft University of Technology Kenew, A.E. (2014) *Geology for Engineering Scientists,* Pearson				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment methods	Written examination (90 min.) and academic performance				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering				

	B.Sc. Environmental Engineering
Prerequisites for participation	Knowledge of mathematics and sciences
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

FLME220 – FLUID MECHANICS

Module title	Fluid Mechanics			**Module-Code**	FLME220
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	4
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. N. Battulga			**Language**	English
Syllabus	Properties of fluids, flow kinematics, conservation equations, constitutive equations, equations of motion, hydrostatics, turbulent flows.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. explain the origins and limitations of the basic conservation equations of fluid mechanics (mass, momentum, moment of momentum, energy). 2. choose the correct equations, simplifications and boundary conditions for a given application and recognise avenues for solution. 3. calculate pressure losses for simple flow networks.				
Literature	Elger, D.F.; Williams, B.C.; Crowe, C.T. and Roberson, J.A. (2012) *Engineering fluid mechanics*, 10th edition.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment methods	Written examination (180 min.) and academic performance				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering				
Prerequisites for participation	None				
Requirements for receiving credit points	Passing the module				
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%				

SCIM200 – SCIENTIFIC METHODS

Module title	Scientific Methods			**Module-Code**	SCIM200
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	4
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	Prof. L. Altangerel			**Language**	English

Syllabus	This topic introduces students to the broad quantitative and qualitative approaches to research in the field of education. Students examine the key steps in the process of conducting research including identifying research problems, reviewing the literature, developing research questions, collecting and analysing data, and reporting and evaluating research. Students are asked to consider the context, nature and purposes of research in selecting a research method. Students are encouraged to integrate their research interest in their learning process. The module aims to • introduce to a range of approaches to scientific research and relationship to philosophical thinking; • critically examine the similarities and differences between quantitative and qualitative research works and their effect on research method selection; • develop an understanding of the key elements of the research process including: research problems, literature, reviews, research questions, collecting and analyzing data as well as reporting and evaluating research
Learning outcomes	On successful completion of this module, the students should be able to: 1. identify and describe a variety of approaches to research, their similarities and differences, and arguments for and against the use of each approach. 2. develop an understanding of the key elements of the research process including research problems, literature reviews, research questions, collecting and analyzing data; and reporting and evaluating research. 3. understand scientific research papers and recognize articles that addresses an area of research from different philosophical perspectives. 4. identify original contributions to research, to policy and/or management and/or practice. 5. carry out independently a small scale research.
Literature	Alreck, P.L. and Settle, R.R. (1995) *The Survey Research Handbook,* Irvin/McGraw-Hill.

	Degrazia, D., Mappes, T. A. and Brand-Ballard, J. (2011) *Biomedical Ethics. 7th edition*, McGraw-Hill.
Form of teaching	Recitation (2 UoI)
Assessment methods	Academic performance and final paper
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	Pass/Fail

CAD220 – COMPUTER- AIDED DESIGN (CAD)

Module title	Computer- aided Design (CAD)				**Module-Code**	CAD220
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	4
Credit points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module coordinator	E.Baljinnyam			**Language**	English	

Syllabus	Current CAD developments, modelling and modelling strategies, Computer Aided Design using software tools like AutoCAD, Lumion 3D, 3Ds MAX, Edius 7 • Working Space and Commands • Basic drawing skills using CAD, Drawing Aids, Editing Entities • Layers, Dimensioning and Hatching • Working groups, dynamic blocks, data attributes (AutoCAD Designer) • 3D isometric drawings, 3D Gizmo Editing, Rendering of solid models • Modeling Techniques, 3Dwalk and 3Dfly • 3D Printing and Animation
Learning outcomes	On successful completion of this module, the students should be able to: 1. describe and apply CAD and modelling systems. 2. classify the development of CAD processes.
Literature	The literature depends on computer programs (AutoCAD, CATIA, PROEngineer) chosen, on-line tutorials are available Lang, K. (2013) *AutoCAD Tutor for Engineering Graphics*, Delmar Dix, M. and Riley, P. (2015) *Discovering AutoCAD*, Pearson
Form of teaching	Lecture (1 UoI) Laboratory (3 UoI)
Assessment methods	Written examination (90 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Completion of *Engineering Design* recommended.

Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

MECH233 – ENGINEERING MECHANICS III (MECHANICS OF MATERIALS)

Module title	Engineering Mechanics III (Mechanics of Materials)			**Module-Code**	MECH233
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	4
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. N.Odbileg			**Language**	English
Syllabus	Definition of stresses in 2D and 3D representation, deformation and strain rate, Hooke's law, Mohr's circle, strength hypotheses, bending of beams, torsion, energy principles in elastostatics, stability and buckling.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. describe one-, two- and three-dimensional stress states and to identify the corresponding principal stresses. 2. design beams and shafts on the basis of strength 3. determine deflection beams and shafts 4. apply the theorem of work balance and the principle of virtual forces 5. analyse simple stability problems and apply Euler's buckling cases.				
Literature	Hibbeler, R.C. (2011) *Mechanics of Materials,* 11th edition. Beer, F.P., Johnston, E.R. and DeWolf, J.T. (2004) *Mechanics of Materials*, 3th edition.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment methods	Written examination (120 min.) and academic performance				
Associated study program	B.Sc. Mechanical Engineering				

	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Engineering Mechanics I: Statics
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

PROC335 – THERMODYNAMICS FOR CHEMICAL ENGINEERING

Module title	Thermodynamics for Chemical Engineering				**Module-Code**	PROC335
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	4
Credit points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module coordinator	Prof. M.Bayanmunkh			**Language**	English	
Syllabus	Physical properties of gases and liquids. Chemical potential and fugacity. Gibbs' fundamental equation. Equilibrium conditions. Gibbs-Duhem equation. Excess Gibbs free energy. ge models. Vapour-liquid equilibria. Azeotropy. Enthalpy/ temperature diagrams.					
Learning outcomes	On successful completion of this module, students should be able to: 1. Explain the fundamental equations of thermodynamics for multicomponent systems and the Legendre-transformation for these systems. 2. Discern intensive from extensive thermodynamic variables, derive the Gibbs-Duhem equation, and apply it to various heterogeneous equilibria. 3. Retrieve the basic physical properties of gases, liquids and solids, and their dependencies on temperature, pressure, and composition from the scientific literature and data bases, regress these data, and judge their reliability. 4. Explain the concepts of chemical potential and fugacity in their molecular context. 5. Analyze, model and simulate non-ideal behavior in the gas phase, and in the liquid phase using equations of state or models for the excess Gibbs free energy. 6. Calculate and sketch enthalpy-temperature diagrams of pure substances.					
Literature	Koretsky, M.D. (2012) *Engineering and Chemical Thermodynamics*, 2nd ed., Wiley.					
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)					
Assessment methods	Oral exam (30 min.) and academic performance					
Associated study program	B.Sc. Raw Materials and Process Engineering					
Prerequisites for participation	Completion of *Engineering Thermodynamics* recommended					
Requirements for receiving credit points	Passing the module					

Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%

ENSO200 – ENGINEER IN SOCIETY

Module title	Engineer in Society				**Module-Code**	ENSO200
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	4
Credit points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module coordinator	Prof. N.Dorjderem			**Language**	English	

Syllabus	Team teaching: The role of the engineers in the society; focus on science and responsibility.
Learning outcomes	On successful completion of this module, the students should be able to: 1. differentiate between basic tenets of engineering science, natural science and the humanities and to recognise the relevance for their profession. 2. think critically about the role of the engineers in the society. 3. recognise the ethical responsibility of the engineers in concrete situations and analyse and reflect these problems by using approaches from engineering ethics and argue in. 4. reflect ethical problems caused by new technological developments, future questions involving technological policies and questions of political shaping and guiding of technological developments while considering their context within society and politics. 5. think critically about specialist literature on basic tenets of science and the ethics of engineering 6. express oneself in a differentiated way but yet be clearly understood both in oral and written form questions involving the basic tenets of science and ethics in an interdisciplinary context.
Literature	Martin, M.W. and Schinzinger, R. (2010) *Introduction to Engineering Ethics*. Rees, M. (2004) *Our final hour,* Basic Books. Lawler, R. (2013) *Engineering in Society*, Royal Academy of Engineering.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment methods	Essay and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering

	B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	Pass/fail

PROC330 – INTRODUCTION TO MINING

Module Title	Introduction to Mining			**Module-Code**	PROC330
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	5
Credit Points	6 CP	**Workload**	180 h	**Contact hours**	60 h
				Individual study	120 h
Module Coordinator	Prof. P.Vossen			**Language**	English

Syllabus	Introduction to the terminology and symbols used in mining. The importance of surface mining for extracting raw materials: stages in surface mining, the influence of deposits and rock parameters on the selection of machinery, principles of formation of technological chains for the main processes of extraction, loading, transporting, and tipping and, where necessary, crushing and storage. Basic technologies for surface mining: spatial development of an excavation, introduction to the technology of large-scale open-cast mining, basic calculations, and sample case studies, practical work in extraction by cutting. The part-processes for underground mining will also be described, and their respective interdependency, technical process chains, the scale of the operations, department sizes, extraction, and transportation processes, selection criteria for equipment, and organization of the processes.
Learning Outcomes	On successful completion of this module, students should be able to: 1. Recognize the machines and technologies used in open pit and underground mining. 2. Identify the principles of the technologies covered, and influence the factors for their application. 3. Choose appropriate technologies for given circumstances. 4. Calculate the main parameters of simple technological chains.
Literature	Mongolian Mining Journal, www.mongolianminingjournal.com Hartman, H. and Mutmansky, J.M. (2015) *Introductory Mining Engineering,* John Wiley & Sons Darling et. al. (2011) *SME Mining Engineering Handbook*, Society for Mining, Metallurgy, and Exploration. Hustrulid, W.A. (2013) *Open Pit Mine Planning and Design*, CRC Press. Stoll, R.D. et. al. (2009) *Der Braunkohlentagebau*, Springer.
Form of teaching	Lecture (3 UoI) Recitation (1 UoI)

	Field trip (1 UoI)
Assessment methods	Written examination (90 min.) and academic performance (tests and participation in the practical lab work and in a field trip to a surface mining operation)
Associated study program	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Basic knowledge of mathematics and natural science
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

MPPM330 – MECHANICAL PROCESS ENGINEERING I

Module Title	Mechanical Process Engineering I				**Module-Code**	MPPM330
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	5
Credit Points	4 CP	**Workload**	120 h	**Contact hours**		36 h
				Individual study		84 h
Module Coordinator	Ch. Munkhjargal			**Language**	English	

Syllabus	Mineral Processing (4 CP): definition and importance of mechanical separation in mineral processing, physical properties of minerals for separation, particle characterization, and particle liberation. Basic operations in procedural technique: comminution and size separation technologies, basic principles of size classification, principles of crushing technology, devices for classification and comminution. Principles of sedimentation and solid-liquid separation. Importance of ore sampling procedure. Process selection and flowsheet design in mineral processing.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe and explain the importance of mechanical separation, physical properties of minerals, and their effects for separation. 2. Design base enrichment flow sheets. 3. Evaluate mechanical separation results. 4. Determine particle liberation. 5. Evaluate the performance of comminution and classification equipment. 6. Enrichment by size classification.
Literature	*AT Mineral Processing Journal.* Weiss, N.L. (1985) *SME Mineral Processing Handbook*, New York: Society of Mining Engineers. Wills B.A., (1988) *Mineral Processing Technology,* 4th edition, Pergamon Pres, Oxford.
Form of teaching	Lecture (1 UoI) Recitation (1 UoI) Laboratory (1 UoI)
Assessment methods	Written examination (90 min.) and academic performance

Associated study program	B.Sc. Mechanical Engineering students will be taught only Mechanical Process Engineering II part. B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Completion of Chemistry and Physics recommended
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examinations accounting for 70%

PROC432 – HEAT AND MASS TRANSFER

Module title	Heat and Mass Transfer			**Module-Code**	PROC432
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	5
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. N.Battulga			**Language**	English

Syllabus	Steady and non-steady, one- and multi-dimensional heat conduction. Convective heat transport: balance equations for mass, momentum and energy, Nusselt equations. Evaporation and condensation: basic calculations for heat exchangers. Heat transport and heat exchange by radiation. Mass transfer and analogies to heat transfer.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Analyze stationary and transient heat conduction problems, and derive the describing differential equations. 2. Solve such equations for simple geometries and boundary conditions. 3. Derive differential equations for convective heat transport problems, and outline the path for their solution. 4. Calculate heat transfer coefficients from the Nusselt equations. 5. Analyze and calculate heat flow in heat exchangers. 6. Describe heat radiation problems. 7. Use the analogy between heat and mass transport for mass transport calculations.
Literature	Baehr, H.D. and Stephan, K. (2011) *Heat and mass transfer*, Springer, 3rd. ed.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment methods	Written examination (120 min.) and academic performance
Associated study program	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module

Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%

RREC330 – RAW MATERIALS AND RECYCLING

Module Title	Raw Materials and Recycling				**Module-Code**	RREC330
Duration	1 semester	**Semester**	Fall semester		**Module-Start**	5
Credit Points	4 CP	**Workload**	120 h	**Contact hours**		36 h
				Individual study		84 h
Module Coordinator	Prof. P. Vossen			**Language**	English	

Syllabus	The technical and legal principles will be covered in relation to selected topics in raw material management and recycling: • Legal principles (material-specific and country-specific). • Quantities of waste material and primary raw material. • Raw material prices and recycling costs. • The market for secondary raw materials. • Quality requirements, and basic technical principles. • Examples of recycling processes. • Current legal requirements, and the effects and repercussions upon trade, industry, and local authorities. • Demonstration of various different economic measures for recycling by means of practical examples. Cycles will be considered in the following industrial sectors: iron and steel, non-ferrous metals, mineral raw materials, and wood.
Learning outcomes	On successful completion of this module, students should be able to: 1. Describe the technical and economic principles of lifecycle economy, recycling, and the identification and remediation of contaminated sites. 2. Explain the technical relationships, the differences between free and regulated markets, and the controlling function of the legal system in recycling, and the remediation of contaminated sites. 3. Apply the gained knowledge by carrying out a piece of independent practical work, and publicly presenting their knowledge and experience of complex technical/economic/legal matters.
Literature	Bilitewski, B. (2010) *Waste Management*. Springer. Pichtel, J. (2014) *Waste Management Practices*. CRC Press. Rowe, D.R. (1995) *Handbook of Wastewater Reclamation and Reuse*, Lewis Bagchi, A. (2004) *Design of Landfills and Integrated Solid Waste Management*. Wiley.
Form of teaching	Lecture (2 UoI)

	Recitation (1 UoI)
Assessment methods	Written examination (60 min.) and academic performance
Associated study program	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%

HSE300 – HEALTH-SAFETY-ENVIRONMENT (HSE)

Module Title	Health-Safety-Environment (HSE)				**Module-Code**	HSE300
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	5
Credit Points	4 CP	**Workload**	120 h	**Contact hours**		48 h
				Individual study		72 h
Module Coordinator	Ch.Munkhjargal			**Language**	English	

Syllabus	a) Principles of Health/Safety/Environment Management (HSE) History, terminology, basis, duties and quality goals of HSE; overview of national and international law, sustainability model/indicators; principles of complex working systems, cause and effect model, risk reduction model, regional material flow and area management, operational material flow management; health/safety/environmental technology, working environment, organisation and human behaviour; overview, selected risks and stresses, emissions and immissions; event statistics, environmental auditing, environmental compatibility, environmental declaration, environmental performance assessment, principles of ecological life cycle balancing, principles for constructing and implementing management systems (PDCA cycle) b) Methods for Health/Safety/Environment Management Assessment of HSE effects (basis and methods for form-based assessment, determination and evaluation of risks and stresses, analysis methods); hierarchy of protective measures, key performance indicators (KPIs), ecological book-keeping, estimation of technical consequences, methods for quantifying the environmental relevance of emissions and immissions, audits, continuous improvement process, etc.); prevention, operation with goals, influencing behaviour, environmental cost calculation, eco-cost control; Certification of management systems (e.g. EMAS, EN ISO 14001 ff., EN ISO 9001 ff., OHSAS 18001 ff.), integrated management system
Learning Outcomes	On successful completion of this module, the students should be able to: 1. Describe the basic scientific principles, methods and instruments for protection of the workplace, health and the environment, and sustainability management, and to apply the requirements of the standards to selected operational examples. 2. List the risks and stress factors and evaluate emissions and immissions.

	3. Analyse complex work systems in terms of the causal chain (cause-effect-damage) and select protective measures. 4. Describe the structure, content and goals of the main HSE management systems, describe the duties of the technical and managerial personnel in terms of analysis, organisation and activities
Literature	Center for the Advancement of Process Tech, (2009) *Safety, Health, and Environment*, Prentice Hall PTR
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Field trip (1 UoI)
Assessment methods	Written examination (90 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module and participation in the Field trip
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

PROC334 – MECHANICAL PROCESS ENGINEERING II

Module title	Mechanical Process Engineering II				**Module-Code**	PROC334
Duration	1 semester	**Semester**	Spring semester		**Module-Start**	6
Credit points	6 CP	**Workload**	180 h	**Contact hours**		60 h
				Individual study		120 h
Module coordinator	Ch.Munkhjargal			**Language**	English	

Syllabus	Characteristic properties of minerals leading to their separation, determination of appropriate separation methods, and development of process flowsheets. Sorting processes, principle of gravity separation, heavy medium separation, flotation technique, and their applications. Magnetic separation, electrostatic separation principles, and devices. Dewatering and tailings disposal in mineral processing plants. Understanding of instrumentation and control system in processing plants.
Learning outcomes	On successful completion of the module, the students will be able to: 1. Explain the basic operations in mechanical process engineering. 2. Select and arrange separating devices to suit the specific problems. They will have tested the correct application of their knowledge in practical exercises. 3. Identify problems, and develop strategies to solve them. 4. Recognize new or different situations and problems, and process them correctly in accordance with the current state of technology.
Literature	*AT Mineral Processing Journal.* Weiss, N.L. (1985) *SME Mineral Processing Handbook*, New York: Society of Mining Engineers. Wills, B.A. (1988) *"Mineral Processing Technology",* 4th edition, Pergamon Press, Oxford.
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI) Excursion (1 UoI)
Assessment methods	Written (90 min.) or oral (30 min.) examination and academic performance

Associated study program	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering
Prerequisites for participation	Completion of Physics and Chemistry recommended
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%

MNEN330 – MINING AND ENVIRONMENT

Module title	Mining and Environment			**Module-Code**	MNEN330
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	6
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. P. Vossen			**Language**	English
Syllabus	The module deepens the view of engineers for the responsibility of mining operations regarding environmental belongings like • Rehabilitation (reclamation and recultivation). • Assessing and minimizing intervention. • Compensation measures. • Environmental impact and spatial significance. • Resettlement problems. • Land rehabilitation. • Internal and external water cycles involved in raw materials operations. Dust and noise emissions/immissions.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe and interpret the market pressures under which raw materials companies must operate today. 2. Summarise and evaluate the current requirements for environmental protection as applied to raw material extraction. 3. Reflect the awareness of the whole question of environmental protection. 4. Recognize and evaluate specific problems by given case studies				

Literature	Spitz, K. (2008) *Mining and the Environment. From Ore to Metal*, CRC Press. Hustrulid, W.A. (2013) *Open Pit Mine Planning and Design*, CRC Press. Azcue, J.M. (2011) *Environmental Impacts of Mining Activities. Emphasis on Mitigation and Remedial Measures*, Springer. Stoll, R.D., Niemann-Delius, C., Drebenstedt, C. and Müllensiefen K. (2009) *Der Braunkohlentagebau*, Springer. Lottermoser, B. (2010) *Mine Wastes,* Springer, Heidelberg.
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Field trip (1 or 2 days)
Assessment methods	Written examination (60 min.) and academic performance
Associated study program	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

ENST330 – ENERGY SYSTEMS

Module title	Energy Systems				**Module-Code**	ENST330
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	6
Credit points	6 CP	**Workload**	180 h	**Contact hours**		48 h
				Individual study		132 h
Module coordinator	Prof. P. Ariunbolor			**Language**	English	

Syllabus	This module introduces students to both conventional and renewable energy sources, energy generation techniques, and the efficiency of energy production and usage: • Conventional energy sources (fossil fuels, nuclear energy): raw material extraction, transport and processing, typical techniques of conventional energy generation, environmental impacts (from resource extraction to energy production). • Renewable energy sources (hydropower, wind power, solar energy, and biomass): ecological advantages, challenges for implementation (cost, suitable locations, acceptance, and negative environmental impacts). • Efficiency at the energy supply side (efficiency factors, energy losses during combustion, transport etc.). • Efficiency of energy usage in industry, at the municipal and domestic level (e.g. heating/insulation, efficiency of electrical appliances, energy efficiency in the transportation sector). • Student project: Assessment of energy efficiency at GMIT in Nalaikh
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the principles of the technical construction of renewable energy systems (Energy Sources, Solar Photovoltaic, Solar Tracking, Charge Controller and Inverter, Wind Power Systems, Wind Turbine Control, Biomass Technologies, Geothermal Power Generation, Energy from Water, Fuel Cells, Generators). 2. Describe the relevance of the energy production sector for environmental degradation and a sustainable future. 3. Critically reflect the advantages and disadvantages of different conventional and renewable energy sources and production techniques. 4. Assess the efficiency of energy production and consumption for typical examples from Mongolia (e.g. thermal power plants, insulation of buildings, transport sector). 5. Apply knowledge about the preconditions for an effective usage of energy system

Literature	Demirel, Y (2016): E*nergy - Production, Conversion, Storage, Conservation, and Coupling*. Springer, London Buchla D.M., Kissel, T.E. and Floyd T.L. (2015) *Renewable Energy Systems*, Pearson
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Excursion (1 UoI)
Assessment methods	Written examination (90 min.) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Environmental Engineering
Prerequisites for participation	Introduction to Electrical Engineering
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%.

INTR340 – INDUSTRIAL INTERNSHIP + REFLECTION

Module title	Industrial Internship+ Reflection			**Module-Code**	INTR340
Duration	1 semester	**Semester**	Spring Semester	**Module-Start**	6
Credit points	14 CP	**Workload**	14 weeks internship plus 24 h	**Contact hours**	
				Individual study	24 h
Module coordinator	Program Coordinators			**Language**	English
Syllabus	TBD prior to internship. The Industrial Internship experience provides students with opportunities to explore career interests while applying knowledge and skills learned in the classroom in a work setting. Internship experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to create professional networks.				
Learning outcomes	A After taking part in the industrial placement, the student should be able to: 1. Explain the social side of the work process based on secondary socializing in the business, and describe the business as a social structure. 2. Assess his or her future position and prospects in the business. 3. Provide a written statement of the activities carried out, and appropriately record their observations and experiences. 4. Assess the specialization that he/she will choose for his/her career based on the studies to date, and the overall appreciation that has been gained by exposure to the practical, and in-depth experience of their theoretical knowledge. 5. Describe and evaluate the complex interrelationships between the areas preceding and following the production area. 6. Produce a written record of complex technical relationships and production processes.				
Literature	none				
Form of teaching	Industrial internship (14 weeks)				
Assessment methods	Written report (min. 10 p.) and oral presentation (20 min.)				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering				

Prerequisites for participation	Completion of Basic Internship
Requirements for receiving credit points	Confirmation of participation in the internship, Acceptance of the written report , participation in the seminar
Grading system	Pass / fail

PROC431 – CHEMICAL REACTION ENGINEERING

Module title	Chemical Reaction Engineering			**Module-Code**	PROC431
Duration	1 semester	**Semester**	Fall semester	**Module-Start**	7
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Module coordinator	Prof.M.Hampe			**Language**	English
Syllabus	Reaction kinetics. Design of batch reactors. Design of continuous flow reactors. Isothermal reactors. Multiple reactions. Enzymatic reactions and bioreactors. Steady state non-isothermal reactors. Non-stationary non-isothermal reactors. Residence time distribution.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Interpret experimental kinetic data of chemical reactions, and simulate reaction rates. 2. Set up mass balances for batch reactors, semi-batch reactors, continuously stirred tank reactors, tubular flow reactors, and packed bed reactors. 3. Solve ordinary differential equations for stationary and non-stationary isothermal reactors. 4. Analyze, model and simulate enzymatic reactions. 5. Design and scale-up bioreactors. 6. Model and simulate non-isothermal reactors. 7. Model and simulate non-steady reactors, and reflect on reactor safety. 8. Analyze, model and simulate heterogeneous catalytic reactors				

	9. Measure, model and simulate residence time distributions in reactor cascades, tubular flow reactors, and packed bed reactors.
Literature	Fogler, S. (2005) *Elements of Chemical Reaction Engineering*, 4th ed., Pearson Prentice Hall. Schmidt, L.D. (1998) *The Engineering of Chemical Reactions*, Oxford University Press. Jess, A. and Wasserscheid, P. (2013) *Chemical Technology: An Integral Textbook*, Wiley.
Form of teaching	Lecture (2 UoI) Recitation (1 UoI)
Assessment methods	Written examination (90 min.) and academic performance
Associated study program	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Completion of semesters 1-4
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%

PROC333 – FOSSIL FUEL TECHNOLOGY

Module title	Fossil Fuel Technology			**Module-Code**	PROC333
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	7
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Ch.Munkhjargal			**Language**	English

Syllabus	The lectures on “Primary Energy Sources” cover the calculation and provision of energy requirements, the development of fossil sources of primary energy, the classification, properties and characterisation of solid, liquid and gaseous fuels, the occurrence and consumption of energy sources and the principles of setting energy prices. The lectures on “Thermo-chemical Fuel Conversion“ will deal with the thermo- chemical conversion processes in terms of their material, thermodynamic and kinetic principles – starting with the structural form and the refining properties of gaseous, liquid and solid fuels. The focus will be placed on the processes of pyrolysis and gassing, extended by liquefaction. The main applications of these processes will be explained in process terms and classified technologically. These include carbonisation and coking of biomass, lignite and coal, gassing of solid fuels in solid beds, fluidised beds and entrained flow, cracking of gaseous and liquid hydrocarbons, hydrogenation of coal and the production of carbon absorbents.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the occurrence, properties and consumption of energy sources. 2. Determine the thermo-chemical conversion processes of fossil fuels. 3. Distinguish the technical applications of power generation from fuels and synthetic gases, hydrogen, coke or carbon-based raw materials.
Literature	Higman, C. and van der Burgt, M. (2003) *Gasification,* Elsevier Science. Jess, A. and Wasserscheid, P. (2013) *Chemical Technology: An Integral Textbook*, Wiley.
Form of teaching	Lecture (2 UoI)

	Recitation (2 UoI)
Assessment methods	Oral examination (30 min.) and academic performance
Associated study program	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Completion of *Chemistry* and *Engineering Thermodynamics* recommended
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

PROC434 – HYDROMETALLURGY

Module title	Hydrometallurgy			**Module-Code**	PROC434
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	7
Credit points	6 CP	**Workload**	180 h	**Contact hours**	72 h
				Individual study	108 h
Module coordinator	Prof. M. Bayanmunkh			**Language**	English
Syllabus	Theoretical principles: • Solid-liquid reactions in the aqueous solution • Thermodynamics and kinetics aspects of hydrometallurgy • Selectivity series of ion exchangers • Bases of solvent extraction • Electrochemical processes/equilibria • Electrochemical phase boundary reactions etc. Various hydrometallurgical processes, which are used for extraction and refining of non-ferrous metals and recyclable materials with • Leaching/Bioleaching, • Solvent extraction, • Precipitation • Electrowinning • Electrorefining Process examples from non-ferrous metallurgy				
Learning outcomes	On successful completion of this module, the students should be able to:				

	1. Describe and apply the process-determining mechanisms and process parameters of hydrometallurgy 2. Interpret of kinetics and thermodynamics by hydrometallurgical process 3. Utilize of plant principles, design and scale up 4. Expend of different mechanisms of bioleaching in applications for the production of nonferrous metals. 5. Use the commonly applied bioleaching bacteria, their metabolism, and the respective cultivation techniques
Literature	Norman L. Weiss, *SME Mineral Processing Handbook*, Volume 2, Hydrometallurgy Section 13. G. van Weert, (1997) *Hydrometallurgy*, Part A and B. Pawlek. F. (1983) *Metallhuettenkunde*. Donati, E.R. and Sand, W. (eds.) *Microbial Processing of Metal Sulfides*. Springer Rawlings, D.E. and Johnson, D.B. (eds.) *Biomining*, Springer. Abhilash, Pandey, B.D., Natarajan, K.A. (eds.) *Microbiology for Minerals, Metals, Materials, and the Environment.* CRC Press
Form of teaching	Lecture (2 UoI) Recitation (2 UoI) Laboratoty (1 UoI) Field trip (1 UoI)
Assessment methods	Written examination (90 min.) and academic performance
Associated study program	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

PROC435 – THERMAL UNIT OPERATIONS

Module title	Thermal Unit Operations				**Module-Code**	PROC435
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	7
Credit points	6 CP	**Workload**	180 h	**Contact hours**		60 h
				Individual study		120 h
Module coordinator	Prof. M. Bayanmunkh			**Language**	English	

Syllabus	Equilibrium stage, non-equilibrium stage, separation cascade, absorption, adsorption, crystallization, distillation, drying, evaporation, extraction, and membrane processes.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the concepts of the equilibrium and the non-equilibrium of the separation stage, and the counter-current separation process. 2. Set up mass and energy balance equations for stage and cascades. 3. Calculate counter-current processes by graphical methods (McCabe-Thiele, Ponchon-Savarit). 4. Describe drying, absorption, crystallization, and membrane processes based on the underlying thermodynamic principles. 5. Set up and calculate mass, and energy balance equations for drying, absorption, crystallization and membrane processes. 6. Explain the method of operation of important industrial counter current separation processes.
Literature	McCabe, W.L., Smith, J.C. and Harriott, P. (2004) *Unit Operations of Chemical Engineering*, 7th ed., McGraw-Hill.
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (2 UoI)
Assessment methods	Oral examination (30 min.) and academic performance
Associated study program	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Completion of *Thermodynamics for Chemical Engineering* recommended
Requirements for receiving credit points	Passing the module

Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%

STWR440 – SCIENTIFIC WRITING

Module title	Scientific Writing			**Module-Code**	STWR440
Duration	1 Semester	**Semester**	Fall Semester	**Module-Start**	
Credit points	4 CP	**Workload**	120 h	**Contact hours**	24 h
				Individual study	96 h
Module coordinator	Program Coordinators			**Language**	English

Syllabus	This module instructs the basics required for the scientific writing and publishing of project works and bachelor theses, and for producing reasonable presentations for conferences, seminars, etc.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Utilize the principles of scientific writing. 2. Competently recapitulate issues. 3. Carry out literature researches. 4. Grasp didactically prepared mediation. 5. Give and assess verbal presentations. 6. Apply moderation techniques.
Literature	
Form of teaching	Recitation (2 UoI)
Assessment methods	Homework, Project work, Presentations
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	Pass/fail

THES440 – BACHELOR THESIS + COLLOQUIUM

Module title	Bachelor Thesis + Colloquium				**Module-Code**	THES440
Duration	1 Semester	**Semester**	Spring Semester		**Module-Start**	8
Credit points	12 CP	**Workload**	360 h	**Contact hours**		
				Individual study		360 h
Module coordinator	Supervisors			**Language**	English	

Syllabus	Current research topics from the general research area of the administering institute.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Solve scientific questions in a structured manner using engineering science methods. 2. Critically differentiate between various solutions. 3. Present their results in written and oral form in a scientifically acceptable manner.
Literature	Depends on topic.
Form of teaching	Thesis supervision
Assessment methods	Written thesis (14 weeks handover deadline) and a colloquium (20 min talk followed by a discussion)
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Possible prerequisites will be prescribed by the individual institute supervising the thesis. At least 180 credit points must have been earned.
Requirements for receiving credit points	Passing the thesis and the presentation
Grading system	The final grade for the Bachelor thesis consists of the grade of the thesis and of the grade of the performance in the colloquium with a weighting of 4:1 provided that the thesis grade was rated at least as “passed”.

PROC433 – PROCESS SYSTEM ENGINEERING

Module title	Process System Engineering				**Module-Code**	PROC433
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	8
Credit points	8 CP	**Workload**	240 h	**Contact hours**		72 h
				Individual study		168 h
Module coordinator	Prof. M.Hampe, Prof.M. Bayanmunkh			**Language**	English	

Syllabus	Systems engineering concepts, process analysis, process synthesis, physical property retrieval, safety and environmental engineering, mass and energy balances, stationary and dynamic process simulation, energy integration, and economic evaluation of processes.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Apply systems engineering concepts and procedures to the development and design of chemical production plants. 2. Follow and apply recursive procedures to develop a process structure at the functional level, the physical level, and the embodiment level. 3. Propose and judge unit operations and separation sequences based on the physical properties, and occupational safety and health data of pure substances and mixtures. 4. Explain and apply the general structure of a) balance equations for mass and energy, b) equilibrium relationships for heterogeneous equilibria, c) transport equations for non-equilibrium processes, d) simulation of reaction kinetics, and e) reaction equilibria, and the implementation of these relationships in process simulation models. 5. Simulate simple processes using the AspenPlus process simulator. 6. Analyze the consumption, generation, and flow of energy in large production units using Linnhoff's Pinch Point Method. 7. Identify the potential for saving energy, and propose appropriate measures. 8. Apply simple methods to estimate cost and profitability of investments in the field of process engineering.
Literature	Turton, R., Baile, R. C., Whiting, W. B., Shaewitz, J. A. and Bhattacharyya, D. (2009) *Analysis, synthesis, and design of chemical processes*, Prentice Hall. Adams II, T. A. (2018) *Learn Aspen Plus in 24 hours*, McGraw Hill.
Form of teaching	Lecture (3 UoI) Recitation (2 UoI)

	Laboratory (1 UoI)
Assessment methods	Oral examination (60 min.) and academic performance
Associated study program	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%

PROJ441 – FINAL STUDY PROJECT

Module title	Final Study Project				**Module-Code**	PROJ441
Duration	1 semester	**Semester**	Spring Semester		**Module-Start**	8
Credit points	6 CP	**Workload**	180 h	**Contact hours**		88 h
				Individual study		92 h
Module coordinator	Program coordinators			**Language**	English	

Syllabus	Students from different engineering disciplines will work as a team on a current research topic.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Solve a design task with the help of systems engineering. 2. Recognize and specify complex problems occurring in industrial practice. 3. Ascertain and evaluate variants within a team solution. 4. Carry out the main features of an exact time and work schedule team, repeatedly, if necessary. 5. Perform different roles in a team. 6. Represent and assess divergent positions, and develop a problem solution.
Literature	The literature for this module depends on the project and will be provided be the program coordinators.
Form of teaching	Project course (2 week interdisciplinary project work, and 1 day field trip), supervised by lecturers of all disciplines involved.
Assessment methods	Written report and oral presentation
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade is based on the written report (70%), and based on the academic performance /oral presentations (30%)

ENGL010 – ENGLISH C1

Module title	English C1				**Module-Code**	ENGL010
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	BEP, 1
Credit points		**Workload**	336 h	**Contact hours**		224 h
				Individual study		112 h
Module coordinator	John Nixon			**Language**	English	
Syllabus	**Grammar Syllabus:** Gerund/ infinitive, the present and stative verbs, used to and would, passive, causative, future, conditionals and wishes, inversion, modal verbs, relatives, indirect speech and reporting verbs, articles and punctuation **Vocabulary and Topical Syllabus:** ambition, career success, pastimes and hobbies, family, media, social problems, technology, science jobs, health problems, school, college, university, advertising, communication					
Learning outcomes	On successful completion of this module, the students should be able to: 1. express themselves clearly and talk about complex facts in a structured and detailed way. 2. use language efficiently and flexibly in their social and professional lives as well as in their studies. 3. write correctly to a large degree on a number of complex topics. 4. understand almost all kinds of spoken language, live or broadcast, at a fast native speed. 5. read with ease abstract, structurally or linguistically complex texts. 6. summarize correctly and concisely written texts and oral presentations in their own words. 7. deliver a presentation using a clear organized structure, helpful slides and signposting. 8. express their opinion as well as disagreement and agreement in a tactful way. 9. describe data, graphs and statistics using appropriate structures. 10. integrate their reading, writing, and speaking skills to promote creative thinking and independent learning.					
Literature	Virginia Evans-Jenny Dooley, Lynda Edwards, Upstream Advanced C1, Express Publishing 2005 Virginia Evans, Lynda Edwards, Jenny Dooley, Upstream Advanced C1, Workbook, Express Publishing 2005					
Form of teaching	Recitation (14 UoI in BEP, 8 UoI in 1st Semester in B.Sc. Programs)					

Assessment methods	Short presentations, in-class assignments, quizzes, written and oral examination
Associated study program	BEP / 1st Semester of Bachelor programs
Prerequisites for participation	Participants must have successfully completed level B2 or have a comparable knowledge of English.
Requirements for receiving credit points	Written examination (90 min), in-class oral examination and academic performance.
Grading system	The modes of assessment total 100%.

ELECTIVE MODULES

ENSS150 – ENGINEERING SUMMER SCHOOL

Module title	Engineering Summer School			**Module-Code**	ENSS150
Duration	2 weeks	**Semester**	Fall or Spring semester	**Module-Start**	2
Credit points	3 CP	**Workload**	90 h	**Contact hours**	60 h
				Individual study	60 h
Module coordinator	Prof. P.Vossen			**Language**	English
Syllabus	Interdisciplinary summer school with reference to GMIT's profile consisting of lab work, excursions, field trips and lectures. The following topics will be covered: • Engineering, especially in the context of the resource industry • Environmental aspects of industrial activities • Mining & industry in Germany • Geology • Intercultural competence & self-organization • higher education institutions and student life abroad The Summer school is accompanied by social events that enforce intercultural contacts.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the general function of industrial or scientific processes covered and the interaction of different processes with another. 2. Identify different materials and their properties and explain their uses in the industrial processes observed. 3. Explain the difference between open pit and underground mining and of the difference technology in use. 4. Describe impacts on the environment and health along the added value chain of natural resources. 5. Perform different activities which are part of mining engineering, such as loading, drilling etc.. 6. Identify minerals and rocks and explain their properties 7. Identify different periods in German history, to compare with Mongolian history and to evaluate the impact of historical developments on the present 8. Apply presentation skills				
Literature					
Form of teaching	Lab work, excursion, field trip, lectures				
Assessment methods	Report, presentation on major program points				

Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Open to 1st year students, in exceptional cases, students of other semesters are eligible, selection criteria, e.g. academic performance, motivation, personal qualification
Requirements for receiving credit points	Attendance of all parts of the program and successful completion of module
Grading system	Pass/fail. Final report and presentation accounting for 50% each.

ENSS151 – ENGINEERING SUMMER SCHOOL

Module title	Engineering Summer School			**Module-Code**	ENSS151
Duration	4 week	**Semester**	Fall or Spring semester	**Module-Start**	4
Credit points	3 CP	**Workload**	90 h	**Contact hours**	60 h
				Individual study	60 h
Module coordinator	Prof. P.Vossen			**Language**	English

Syllabus	Interdisciplinary summer school consisting of lectures, recitations, lab works, excursions and intercultural activities. The following topics will be covered: • Introduction to mining safety engineering • Mining & industry in China • Geology • Culture and language • Modern coal mining technology The Summer school is accompanied by social events that enforce intercultural contacts.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Recognize the work process in the mining area and its social and technical aspect. 2. Assess career prospects in the business. 3. Explain the general function of industrial or scientific processes covered and the interaction of different processes with another. 4. Identify different materials and their properties and explain their uses in the industrial processes observed. 5. Explain underground mining and of the difference technology in use. 6. Describe impacts on the environment and health along the added value chain of natural resources. 7. Identify different periods in Chinese history, to compare with Mongolian history and to evaluate the impact of historical developments on the present. 8. Apply skills in writing of reports and essays.
Literature	
Form of teaching	Lab work, excursion, field trip, lectures
Assessment methods	Report, presentation on major program points
Associated study program	B.Sc. Mechanical Engineering

	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Open to 2nd year students, in exceptional cases, students of other semesters are eligible, selection criteria, e.g. academic performance, motivation, personal qualification.
Requirements for receiving credit points	Attendance of all parts of the program and successful completion of module
Grading system	Pass/fail. Certificate of the course.

ENGL150 – BUSINESS ENGLISH FOR THE WORKPLACE

Module title	Business English for the Workplace			**Module-Code**	ENGL150
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	1, 2, 3, 4, 5, 6, 7, 8
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	John Nixon			**Language**	English
Syllabus	Participants in this course learn • useful and authentic English for the workplace, including vocabulary and common phrases • how to write various types of e-mails and business letters and to respect norms and conventions • how to conduct meetings and negotiations in English • how to conduct telephone conversations in English • how to make small talk and to socialize in professional settings • how to deliver a business presentation • the fundamentals of applying for a job in English, e.g. cover letter and résumé • business etiquette and how to achieve the right tone in different professional situations				
Learning outcomes	On successful completion of this module, the students should be able to: 1. participate in a variety of professional situations with greater ease and in an appropriate manner. 2. write various types of e-mails and business letters. 3. identify and apply vocabulary, morpho-syntactic structures and stylistic forms typical of business communication. 4. conduct meetings, negotiations and telephone conversations. 5. socialize in professional settings with greater ease. 6. deliver a business presentation using the appropriate signposts. 7. apply for a job in English. 8. understand the role culture plays in business interactions. 9. compare and contrast their cultural underpinnings with those in other cultures, especially with regard to business interactions. 10. respond in an intercultural sensitive manner to conflict in business settings.				
Literature	Emmerson, P. (2013). *Email English, 2nd Edition*, Macmillan. Hughes, J. (2006). *Telephone English*, Macmillan. Stephens, B. (2011). *Meetings in English*, Macmillan.				
Form of teaching	student-centred language course (4UoI)				

Assessment methods	Presentation, e-mails, mock meeting/negotiation, final exam
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	C1 level of English
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

MNGL150 – MONGOLIAN STYLISTICS

Module title	Mongolian Stylistics				**Module-Code**	MNGL150
Duration	1 semester	**Semester**	Fall/ Spring semester		**Module-Start**	1, 2, 3, 4
Credit points	2 CP	**Workload**	60 h	**Contact hours**		24 h
				Individual study		36 h
Module coordinator	B.Batsuren			**Language**	English	
Syllabus	Participants will read texts of different genres, discuss text comprehension and analyze how the texts are structured and which stylistic means, grammatical structures and vocabulary are used. Grammar and spelling rules will be revised. Participants will practice text analyses, summaries and, furthermore, apply their knowledge of style, academic vocabulary and grammar to their own text production. Participants will also learn how to express their thoughts in oral speech, e.g. in discussions and presentations.					
Learning outcomes	On successful completion of this module, the students should be able to: 1. comprehend and analyze texts of different genres and recognize their specific characteristics, 2. Write text summaries, 3. Structure their thoughts in a text 4. write a formal letter, an application and other short texts as well as an essay with correct grammar, spelling and using appropriate stylistic means 5. give an academic presentation using appropriate language					
Literature	„Монгол хэлний найруулга зүй“, Ц. Сүхбаатар, УБ., 2007 „Орчин цагийн монгол хэлний найруулга зүйн дасгал“ С. Мөнхцэцэг, УБ., 2016 „Монгол хэлний найруулга зүй“ Ц. Оюунбат, С. Мөнхцэцэг, УБ., 2012 “Монгол хэлний хураангуй тайлбар толь”, Мон судар, 2009					
Form of teaching	Recitation (2 UoI)					
Assessment methods	Final paper and academic performance (tests and homework assignments)					
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering					

Prerequisites for participation	C1 level of English and successful completion of Academic Writing I
Requirements for receiving credit points	At least 70% of the course grade will be based on evaluation of the formal writing. Formal research writing assignments are required.
Grading system	Preliminary Research Portfolio: 20% Critical Presentation: 30% Final Portfolio: 50%

ENGL151 – ACADEMIC WRITING I

Module title	Academic Writing I			**Module-Code**	ENGL151
Duration	1 semester	**Semester**	Fall/ Spring semester	**Module-Start**	1, 2, 3, 4, 5,6
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	John Nixon			**Language**	English
Syllabus	The goal of this module is to offer an introduction to formal writing to the undergraduates which is required in their academic studies at the university. The objectives of the module are to familiarize learners with a formal tone, use of the third-person rather than first-person, focus on the topic, precise word choice on the one part, and to introduce them with a paragraph and essay structures, unity and coherence, outlines, first and second drafts and editing on the other part. The goal and objectives will be achieved by offering the below-mentioned syllabus: • Paragraphs • The five-paragraph essay • Unity within a paragraph and within an essay • Coherence • Brainstorming and making outlines • Drafts and editing • Descriptive essays • Formal emails • CV and motivation or cover letters • Process Analysis Essays • Cause and Effect Essays • Argumentative Essays • Opinion Essays • Reports • Lab report discussions • Reviews				
Learning outcomes	On successful completion of this module, the students should be able to:				

	1. recognize, understand and recall the structural components of academic writing at paragraph and essay levels. 2. identify and apply formal register and tone. 3. analyze and evaluate different types of academic writing, e.g. essays, reviews and reports. 4. summarize the main points of academic texts in writing. 5. organize and present arguments in a logical fashion. 6. apply cohesive devices. 7. create their own pieces of academic writing. 8. critically examine and improve upon their own writing. 9. apply the skills acquired in the module to their further academic studies.
Literature	Alice Savage and Patricia Mayer *Effective Academic Writing 2, 3* Jordan, R.R. (2003) *Academic Writing Course*, Longman. Barnet, S. and Stubbs, M. (1995) *Practical Guide to Writing*, Harper Collins. Websites: IELTS Writing Skills, British Council, BBC Learn English Writing skills
Form of teaching	Recitation (4 UoI)
Assessment methods	Assignments: written and oral in the form of essays or presentations
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	C1 English level
Requirements for receiving credit points	Passing the module.
Grading system	Continuous assessment (presentations and essays): Pass or Fail

ENGL152 – ACADEMIC WRITING II

Module title	Academic Writing II				**Module-Code**	ENGL152
Duration	1 semester	**Semester**	Fall/ Spring semester		**Module-Start**	1,2,3,4,5,6, 7, 8
Credit points	3 CP	**Workload**	60 h	**Contact hours**		45 h
				Individual study		15 h
Module coordinator	Dr. Simon Kim			**Language**	English	
Syllabus	The purpose of this course is to provide participants with the opportunity to improve their skills in writing a research article and other academic texts. This course builds upon the fundamentals that were learned in Introduction to Academic Writing. Students apply what is learned by drafting short academic articles and abstracts related to their area of specialization, all the while critiquing their own writing in an effort to improve their autonomous learning skills.					
Learning outcomes	On successful completion of this module, the students should be able to: 1. Understand the interaction between writer, text and reader. 2. Discriminate between academic writing and other forms of writing and English. 3. Identify and select suitable grammatical structures and academic vocabulary for a variety of texts. 4. Formulate and write a research proposal. 5. Effectively record data and experiments so that others can understand them, and so that they can form the basis of a thesis. 6. Communicate science by means of a thesis, written in the format of a scientific journal article. 7. Practice effective, correct and appropriate writing in the students' area of specialization. 8. Examine and critique their own scientific writing in order to improve upon their own writing. 9. Provide feedback on other people's writing.					
Literature	Rowena Murray, Third Edition (2011). *How to write a Thesis*. Berkshire, England, McGraw Hill Open University Press. Laurie Rozakis. (1999). *Schaum's Quick Guide to Writing Great Research Papers*. NY, U.S.A., McGraw Hill. Beverly Ann Chin. (2004). *How to Write a Great Research Paper*. NJ, U.S.A., John Wiley & Sons, Inc.					
Form of teaching	Lecture					
Assessment methods	A collection of writing that is drafted, revised, and edited during the course is required, including a minimum of 4 extended formal research					

	papers. Rubrics to evaluate student writing will be derived from the outcomes listed above.
Associated study program	
Prerequisites for participation	C1 level of English and successful completion of Academic Writing I
Requirements for receiving credit points	At least 70% of the course grade will be based on evaluation of the formal writing. Formal research writing assignments are required.
Grading system	Preliminary Research Portfolio: 20% Critical Presentation: 30% Final Portfolio: 50%

HIST150 – WORLD HISTORY

Module title	World History				**Module-Code**	HIST150
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	1, 3, 5, 7
Credit points	3 CP	**Workload**	90 h	**Contact hours**		48 h
				Individual study		42 h
Module coordinator	John Nixon			**Language**	English	

Syllabus	This elective surveys the history of Western Civilization from the neo-Lithic (new stone age) period through the late Medieval/early Renaissance period. This course focuses on the advance of modernity in human civilization. Students will discuss the trends, scientific developments, and cultural change in Western Civilization. The focus will be on the exploration and critique of the European civilization because circumstance has granted Western Civilization relative dominance in world affairs.
Learning outcomes	On successful completion of this module, the students should be able to: 1. describe how cultural change, economic events, evolution of religious thought, and technological change have given Europeans their distinctive worldview and contributed to the present-day world system as well as Mongolia's role in it. 2. define the main characteristics and events in a given historical period. 3. assess scholarly writings and primary source matter critically. 4. draw parallels between events and issues across historical periods. 5. grasp and interpret why and how the Social Sciences contribute significantly to the development of civilization. 6. draft one short research paper at undergraduate university level. 7. examine and edit their own academic writing. 8. plan, organize and carry out tasks independently.
Literature	Duiker, W. J. and Spielvogel, J. J. (2016) *World History 8th edition*. Spielvogel, J. V. (2008) *Glencoe World History*, Glencoe-McGraw Hill. Various primary source materials in photocopy
Form of teaching	Recitation (4UoI)

Assessment methods	Written examination (90 min) and academic performance
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	C1 English level
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module (30%) and the module examination (70%).

LITF150 – LITERATURE AND FILM

Module title	Literature and Film				**Module-Code**	LIFT150
Duration	1 semester	**Semester**	Fall/ Spring Semester		**Module-Start**	1, 2, 3, 4, 5, 6, 7, 8
Credit points	3 CP	**Workload**	90 h	**Contact hours**		48 h
				Individual study		42 h
Module coordinator	John Nixon			**Language**	English	
Syllabus	This module surveys the art of literature and film and the role they play in our lives. Selected pieces of literature and the film versions based on them are analysed as unique pieces of art using different techniques to tell stories. In addition to that, the possibilities, challenges and results of the transposition of literature to film are investigated.					
Learning outcomes	On successful completion of this module, the students should be able to: 1. descibe and appreciate works of literature written in English. 2. analyze works of fiction for plot structure, setting. characterization, theme, and narrative point of view. 3. explain how the story is constructed and the message created. 4. critically examine film adaptations of literary texts along similar techniques but also including the techniques specific to cinema (e.g. sound, special effects, lighting, cut, dialogue). 5. write literature and film reviews appropriately utilizing the terminology of literature and film analysis. 6. express their opinions on the pieces of art using appropriate academic vocabulary. 7. reflect on the potential and limitations of turning literary texts into film and the impact it has on the story and the message. 8. compare and contrast films based on literature with blockbuster films not adapted from literature. 9. distinguish how different media influence our lives, how they can impact emotions or may direct behaviour.					
Literature	Corrigan T. (2018) *Film and Literature: An Introduction and Reader, 2nd Edition* Routledge.					
Form of teaching	Recitation (4 UoI)					
Assessment methods	Academic performance in class (contribution to discussion, short literature and film reviews, project/presentation) and final research paper					

Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	C1 English level
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module (30%) and the final research paper (70%).

GERL151 – GERMAN A1.1

Module title	Deutsch A1.1/German A1.1				**Module-Code**	GERL151
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	1, 3, 5, 7
Credit points	3 CP	**Workload**	90 h	**Contact hours**		48 h
				Individual study		42 h
Module coordinator	John Nixon			**Language**	German	

Syllabus	Basic knowledge and skills in pronunciation, spelling (alphabet), intonation (word and sentence stress) of the German language. Main topics are first contact, classroom language, languages/ countries/ sights, jobs, living, time, numbers, making appointments, how to find the way in the city and in buildings, means of transport. Grammar problems, e.g. sentence structure (statements and questions), present tense of verbs, past tense of “haben” and “sein”, negation, articles, possessive pronoun, use of prepositions (place/time), cardinal numbers, dative and accusative cases, are introduced and practiced. Basic information about German geography and culture is introduced.
Learning outcomes	On successful completion of this module, the students should be able to: 1. know the basic principles of pronunciation, intonation, spelling of German. 2. construct grammatically and semantically correct sentences, produce simple statements and questions in oral communication as well as in writing. 3. introduce themselves and others and make themselves understood in the classroom. 4. talk about the geographical location of places and say where people work/study and ask for the way. 5. describe houses/apartments. 6. tell the time and make appointments. 7. apply integrated learning strategies to improve upon their learning independently.
Literature	Funk/Kuhn. *Studio 21. Das Deutschbuch. A1.1*, Cornelsen Verlag, 2013.
Form of teaching	Recitation (4 UoI)
Assessment methods	Written examination (90 min.) and academic performance (tests and homework assignments)
Associated study program	B.Sc. Mechanical Engineering

	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module.
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

GERL152 – GERMAN A1.2

Module title	Deutsch A1.2/ German A1.2				**Module-Code**	GERL152
Duration	1 semester	**Semester**	Spring semester		**Module-Start**	2, 4, 6, 8
Credit points	3 CP	**Workload**	90 h	**Contact hours**		48 h
				Individual study		42 h
Module coordinator	John Nixon			**Language**	German	
Syllabus	Basic knowledge and skills in pronunciation, spelling, grammar and vocabulary of the German language as well as basic aspects of German culture. The main topics include: food/shopping, professions, daily routine/everyday life, holidays, seasons/weather, fashion, the human body/health. Grammar points include: modal verbs, perfect tense, comparison, adjectives, imperative and personal pronouns. In this module A1 (beginner) level is completed.					
Learning outcomes	On successful completion of this module, the students should be able to: 1. pronounce and spell German words and intone sentences correctly. 2. construct grammatically and semantically correct sentences and make simple statements in oral communication as well as in writing. 3. understand simple everyday conversation and short and simple oral material. 4. talk about professions, clothes, the weather, the human body, feelings, food, holidays and daily routines. 5. give recommendations and write simple letters. 6. understand weather forecasts, recipes and various other short texts of different genres. 7. provide basic facts about Germany and German culture. 8. apply integrated learning strategies to improve upon their learning independently.					
Literature	Funk/Kuhn.*Studio 21. Das Deutschbuch. A1.2*, Cornelsen,2013.					
Form of teaching	Recitation (4 UoI)					
Assessment methods	Written examination (90 min.) and oral examination (15 min.) as well as academic performance (tests and homework assignments)					
Associated study program	B.Sc. Mechanical Engineering					

	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Successful completion of the module German A1.1 or equivalent knowledge of German
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for and the module examination accounting for 70%.

GERL251 – GERMAN A2.1

Module title	Deutsch A2.1/German A2.1				**Module-Code**	GERL251
Duration	1 semester	**Semester**	Fall Semester		**Module-Start**	1, 3, 5, 7
Credit points	3 CP	**Workload**	90 h	**Contact hours**		48 h
				Individual study		42 h
Module coordinator	John Nixon			**Language**	German	

Syllabus	This module will pursue further work to improve students' skills in pronunciation and spelling as well as grammar and vocabulary. Language tasks will include: talking about one's self and one's family, describing people and pictures, extending invitations and congratulating people, expressing one's opinion, talking about trips and one's hobbies, describing one's emotions, discussing advertisements and the media, ordering food in a restaurant and explaining one's leisure time activities The grammar points covered in this module include: subordinate clauses with *weil, dass*, and *ob* comparative and superlative adjectives, possessive article and adjectives in the dative case, the genitive /s/, main clauses with *aber* and *oder* , the modal verb sollen, reflexive pronouns, adverbs of time, verbs with prepositions, indefinite pronouns, personal pronouns in the dative case. Further understanding of aspects of German culture
Learning outcomes	On successful completion of this module, the students should be able to: 1. apply their knowledge of German pronunciation, intonation and spelling to new words and sentences. 2. construct grammatically and semantically correct sentences at a basic level. 3. use proper vocabulary to discuss topics such as family, biography, languages, travelling, leisure and media. 4. produce written texts that go beyond the sentence level. 5. interact successfully and appropriately in everyday oral communication. 6. understand short oral texts. 7. grasp the meaning of various short written texts. 8. describe in more detail many aspects of German culture (e.g. migration, literature, geography). 9. apply integrated learning strategies to improve upon their learning independently.
Literature	Funk/Kuhn. *Studio 21. Das Deutschbuch. A2.1*, CornelsenVerlag, 2015.

Form of teaching	Recitation (4 UoI)
Assessment methods	Written examination (90 min.) and academic performance (tests and homework assignments)
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Successful completion of the module German A1.2 or equivalent knowledge of German
Requirements for receiving credit points	Passing the module.
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

GERL252 – GERMAN A2.2

Module title	Deutsch A2.2/German A2.2				**Module-Code**	GERL252
Duration	1 semester	**Semester**	Spring semester		**Module-Start**	2, 4, 6, 8
Credit points	3 CP	**Workload**	90 h	**Contact hours**		48 h
				Individual study		42 h
Module coordinator	John Nixon			**Language**	German	
Syllabus	This module will pursue further work to improve students' skills in pronunciation and spelling as well as grammar and vocabulary. The language tasks of this module include: talking about moving from the countryside to the city; discussing various forms of culture, applying for a job and describing one's future career plans; celebrations and holidays; emotions and films; innovative ideas and inventions The grammar points covered in this module include: modal verbs in the past, adverbs of time, comparison of the preterite and perfect verb tenses, subordinate clauses with *wenn, als um…zu* and *damit*, the verb *werden*, nominalization, polite requests, prepositions and verbs with the dative case, verbs with accusative complements, genitive case, relative clauses with in and mit, *werden/wurden*. Acquisition of additional aspects of German culture. Completion of level A2 (elementary).					
Learning outcomes	On successful completion of this module, the students should be able to: 1. correctly apply their knowledge in the pronunciation, intonation and spelling of German to new words and sentences. 2. construct grammatically complex and semantically correct sentences. 3. use proper vocabulary to discuss topics such as culture and arts, the workplace and professions, celebrations and holidays, country and city life and inventions and technology. 4. produce more complex written text. 5. interact effectively and appropriately in everyday speaking situations. 6. understand various types of short written texts. 7. grasp the core meaning of a variety of audio and video material of intermediate difficulty. 8. provide basic facts about German culture, geography and society. 9. apply integrated learning strategies to improve upon their learning independently.					

Literature	Funk/Kuhn. (2015) *Studio 21. Das Deutschbuch. A2.2*, Cornelsen.
Form of teaching	Recitation (4 UoI)
Assessment methods	Written examination (90 min.) and oral examination (15 min.) as well as academic performance (tests and homework assignments)
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Successful completion of the module German A2.1 or equivalent knowledge of German
Requirements for receiving credit points	Passing the module.
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

GERL351 – GRMAN B1.1

Module title	Deutsch B1.1/German B1.1			**Module-Code**	GERL351
Duration	1 semester	**Semester**	Fall semester	**Module-Start**	1, 3, 5, 7
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	John Nixon			**Language**	German
Syllabus	Development and application of the knowledge and skills acquired in the A1 and A2 levels. Additional topics include: German/European history, men/women, aspects of professional life and the education system. Grammar points include: subordinated sentences, past tense of irregular verbs, word formation and conditional forms.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. interact adequately in most situations of everyday life. 2. speak in a simple but well-structured way about topics like politics, history, and culture. 3. give recommendations; agree or disagree; express their opinion and give reasons. 4. describe dreams, wishes and goals; and report about experiences and events. 5. read and understand short newspaper articles. 6. write texts on a number of everyday topics that consist of several paragraphs and employ cohesive structures to organize the text as a whole. 7. deliver short presentations on a number of topics related to everyday life, history and culture. 8. understand everyday conversations as well as audio and video material of intermediate difficulty. 9. apply integrated learning strategies to improve upon their learning independently.				
Literature	Funk/Kuhn/Winzer-Kiontke. *Studio 21. Das Deutschbuch. B1.1*, Cornelsen Verlag, 2015				
Form of teaching	Recitation (4 UoI)				
Assessment methods	Written examination (120 min.) and academic performance (tests and homework assignments)				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering				

Prerequisites for participation	Successful completion of the module German A2.2 or equivalent knowledge of German
Requirements for receiving credit points	Passing the module.
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

GERL352 – GERMAN B1.2

Module title	Deutsch B1.2/German B1.2				**Module-Code**	GERL352
Duration	1 semester	**Semester**	Spring semester		**Module-Start**	2, 4, 6, 8
Credit points	3 CP	**Workload**	90 h	**Contact hours**		48 h
				Individual study		42 h
Module coordinator	John Nixon			**Language**	German	
Syllabus	Development and application of the knowledge and skills acquired in the A1 and A2 levels. Additional topics include: climate/environment, conflicts, generations and age, migration and (European) politics. Grammar points include: future and past perfect tense, genitive case, conjunctions and subordinated sentences, word formation and phrasal verbs. Completion of level B1 (intermediate).					
Learning outcomes	On successful completion of this module, the students should be able to: 1. interact adequately and appropriately in all situations of everyday life. 2. speak and write in a simple but well-structured way about topics like climate change and the environment, politics, history and culture. 3. express their opinion and give reasons as well as provide arguments. 4. talk about advantages and disadvantages, give alternatives, comment on various topics of intermediate difficulty. 5. express their problems, fears and hopes both orally and in writing. 6. understand and write basic literary texts. 7. grasp the meaning of a variety of discursive texts of intermediate difficulty. 8. understand conversations as well as authentic audio and video material on a number of topics of intermediate difficulty. 9. give presentations. 10. apply integrated learning strategies to improve upon their learning independently.					
Literature	Funk/Kuhn/Winzer-Kiontke. *Studio 21. Das Deutschbuch. B1.2*, Cornelsen Verlag,2015(tests and homework assignments)					
Form of teaching	Recitation (4 UoI)					
Assessment methods	Written examination (120 min.) and oral examination (15 min.) as well as academic performance					
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering					

	B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Successful completion of the module German B1.1 or equivalent knowledge of German
Requirements for receiving credit points	Passing the module.
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

LNST150 – LEARNING STRATEGIES

Module title	Learning Strategies			**Module-Code**	LNST150
Duration	1 semester	**Semester**	Fall Semester	**Module-Start**	1, 2, 3, 4, 5, 6, 7, 8
Credit points	2 CP	**Workload**	60 h	**Contact hours**	32 h
				Individual study	28 h
Module coordinator	John Nixon			**Language**	English
Syllabus	The module aims at helping students to become motivated and strategic learners who effectively use learning strategies to enhance their learning and academic success. Participants will explore and practice various learning strategies and find out more about themselves as learners. The module includes the following topics: • Motivation • Self-organization (time management, learning conditions, concentration) • Learning styles • Collecting and organizing information • Memorizing • Cooperative learning • Stress management and relaxation techniques • Exam preparation and test taking				
Learning outcomes	On successful completion of this module, the students should be able to: 1. identify their strengths and weaknesses as learners and the obstacles to effective learning. 2. describe different learning styles and identify their own. 3. explain various learning techniques. 4. apply these learning techniques effectively to their own learning process. 5. understand the factors behind motivation and determine what motivates them. 6. set goals and monitor their learning progress. 7. monitor and regulate their time management and organization. 8. prepare for exams purposefully and effectively. 9. apply stress management techniques in order to diminish and handle exam anxiety.				
Literature	Dembo, M.H. (2004) *Motivation and Learning Strategies for College Success. A Self-Management Approach*, Lawrence Erlbaum Associates.				

	Henne, G. (2014) *General Skills I: Learning Techniques, Time- and Self-Management*.
Form of teaching	Recitation (4UoI)
Assessment methods	Assignments and in-class participation
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	C1 English level
Requirements for receiving credit points	Passing the module
Grading system	Pass/Fail

CHEM250 – ANALYTICAL CHEMISTRY

Module title	Analytical chemistry			**Module-Code**	CHEM250
Duration	1 semester	**Semester**	Fall or Spring Semester	**Module-Start**	4 - 6 the semester
Credit points	3 CP	**Workload**	90 h	**Contact hours**	36 h
				Individual study	54 h
Module coordinator	Prof. B.Battsengel			**Language**	English
Syllabus	• Introduction • Measurement, Statistics • Introduction to the Titration • Spectrometry • Electroanalytical methods • Atomic Spectroscopy • Molecular Spectroscopy				
Learning outcomes	The students will be given an introduction to the analytical chemistry and familiarised with the theory and applications of analytical chemistry. Laboratory emphasis on obtaining and interpreting quantitative data. Statistical data analysis, volumetric and gravimetric analysis, fundamentals of spectroscopy, fundamentals of electrochemistry, and analytical separations. On successful completion of this module, the students should be able to: 1. Expertise the professional practice of chemistry. 2. Develop an understanding of the range and uses of analytical methods in chemistry. 3. Provide experience with a wide range of laboratory techniques and instruments, ranging from simple gravimetric and volumetric measurements to optical and spectroscopy. 4. Develop an understanding of the broad role of the chemist in measurement and problem solving for analytical tasks. 5. Meet the standards expected of scientists in acquiring, interpreting, and reporting data. 6. Provide experience in some scientific methods employed in analytical chemistry. 7. Develop skills in procedures and instrumental methods applied in analysis tasks. 8. Develop skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments. 9. Develop written and oral communication of scientific results. 10. Apply some understanding of the professional and safety responsibilities residing in working on chemical analysis.				

Literature	D.A. Skoog, D.M.West, F.J.Holler, S.R. Crouch, (2017), Fundamentals of Analytical Chemistry, 8th Edition D. C. Harris, (2017), *Quantitative Chemical Analysis,* 8th Edition. Skoog, Holler, Crouch, (2007), *Principles of Instrumental Analysis*, 6th Edition
Form of teaching	Lecture (1 UoI) laboratory (2 UoI)
Assessment methods	Written examination 90 min
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering
Prerequisites for participation	Chemistry
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

ENVH150 – ENVIRONMENTAL HEALTH

Module title	Environmental Health			**Module-Code**	ENVH150
Duration	1 semester	**Semester**	Winter semester	**Module-Start**	1
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	Dr. Simon Kim			**Language**	English

Syllabus	This course provides a broad overview of human health and diseases caused by the environmental chemicals and toxins as well as pollution caused by human exploitation of nature, especially by the mining industry. Students are introduced to human diseases by contaminants, pathogens and toxins to realize the seriousness of the environmental diseases and the importance of remediation by the environmental engineering. Students will be exposed to basic concepts of pathology, toxicology, occupational health and industrial hygiene, and consumer health and safety. Topics include contaminants, pathogens and toxins that cause human diseases; pathology of the diseases; symptoms and signs of the diseases; possible treatments and prognoses; and possible approaches to prevent the environmental health problems. • Describe environmental risk factors that affect both personal and population health. • Identify organic and inorganic compounds, and how they influence population health. • Gain knowledge and understanding of the pathology of the environmental diseases. • Understand the symptoms and signs of environmental diseases as well as possible diagnostic measures and treatments. • Discuss the possible prevention methods using the pathology knowledge on environmental diseases.
Learning outcomes	On successful completion of this module, the students should be able to: 1. Gain a general understanding of human health and disease. 2. Recognize major contaminants, pathogens and toxins causing human diseases. 3. Understand how some organic and inorganic compounds become toxic inside of the human body. 4. Identify and examine the cause of environmental diseases.

	5. Formulate possible treatments for these diseases. 6. Outline the basic types of environmental remediation and the importance in terms of improving human health. 7. Describe how to avoid environmental diseases. 8. Develop possible prevention methods. 9. Apply their knowledge gained in the course to the specific situation in Mongolia, especially with regard to the influence of the mining industry on the environment.
Literature	Frumkin, H. Environmental Health: From Global to Local, 3rd Edition (2016). New Jersey, USA. Wiley.
Form of teaching	Lecture (2 UoI)
Assessment methods	Written examination (90 min) and academic performance.
Associated study program	B.Sc. Environmental Engineering/Raw Material Processing Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.