ANNEX 1.

PROGRAM-SPECIFIC STUDY AND EXAM REGULATIONS FOR BACHELOR OF SCIENCE IN RAW MATERIALS AND PROCESS ENGINEERING,

Incl. STUDY PLAN AND MODULE HANDBOOK

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AIMS AND OBJECTIVES

The application-oriented degree course RMPE aims to provide knowledge, abilities, and competencies in engineering, mathematics, and natural sciences to enable the graduate to plan, design, and control the production processes of primary and secondary raw materials extraction, processing, purification, and other materials in economic, ecological, and sustainable ways.

The Bachelor of Science in “Raw Materials and Process Engineering” /RMPE/ is following a four-year (eight academic semesters) undergraduate education program with 240 Credit Points (ECTS), according to European standards. The international accreditation also allows GMIT students to continue their studies in Germany, Europe, and other countries.

To be admitted to the specialized B. Sc. Raw Materials and Process Engineering program, students must complete the “joint foundation studies” course at GMIT, comprising the first four semesters.

Building on this, in the further phase of the course, graduates acquire in-depth and specialized knowledge in the alternative focus areas of "Mineral process engineering I and II", "Hydrometallurgy", "Process systems Engineering" or "Chemical reaction Engineering", which enable them to apply central instruments of the respective focus methodically and conceptually.

The bachelor's thesis develops interdisciplinary problem-solving and synthesis skills for technical systems. Graduates can generate new solutions in their chosen areas of focus.

Graduates with a Bachelor's degree in RMPE can select basic methods in familiar situations to create, develop, and compare production chains. They can take on given problems and the resulting tasks in teams organized on a division of labor basis, work on them independently, integrate the results of others, and present and interpret their results in writing. They can identify, dissect and further develop systems and processes and create given evaluation criteria taking technical, economic, and social constraints into account.

The graduates of the Bachelor of Science degree course “Raw Materials and Process Engineering” will be able to:

- Apply mathematical, scientific, and engineering principles for identifying, formulating, and solving problems of raw materials and process engineering.

- Recognize and analyze complex 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 raw materials and process engineering.
- Apply information science to solve raw materials and process engineering problems.
- Work in international teams in order to solve extensive and interdisciplinary problems.

CURRICULUM STRUCTURE

The study plan contains the course and examination plans relevant to the Bachelor's degree program in RMPE are listed. The semester location of the module examination, the number of credit points allocated and the associated examination prerequisites are specified for each module. To achieve the aims and objectives of the Raw Material Process Engineering, the curriculum is structured to educate students 1) first two years- to prepare the foundation knowledge for raw materials and process engineering. The curriculum for the first two year focuses on scientific and basic engineering modules such as Mathematics, Chemistry, Physics, and Engineering Thermodynamics, Fluid mechanics, Raw Materials Recycling etc. Also, the soft skills such as communication skills, technical English and German, and Scientific methods are taught. The curriculum for the third year provides special basic engineering modules to help students to build and expand basic engineering knowledge and characters. Thus, the modules for introductory of Raw materials and Process Engineering and modules for general engineering are taught. Also, professional internship module provides students with opportunities to learn and practice engineering skills in real situation. Finally, the fourth year is dedicated to equip students with professional knowledge and engineering skills which are to be used for their career. Bachelor thesis provides research experience to solve an engineering problem and to write a logical engineering document. Especially, the final study project offers students an opportunity to cooperate with students from other engineering fields to solve a real engineering problem.

MODULE DESCRIPTIONS

The description of each module is provided in this document following Study Plan.

ELECTIVES

Students take English and German language modules as electives. Every 3rd and 4th year student can choose professional engineering modules from the other programs as electives. Presupposed for participation and recognition of the elective module is that the required prerequisites of the chosen elective module already have been passed. Furthermore, the adjustment of the lecture times for attendance in the chosen elective modules can only be made by ASA in exceptional cases. The student must choose his/her subjects in such a way that participation in his/her program-related modules is not endangered or restricted.

STUDY PLAN

CPs	1st Semester	2nd Semester	3rd Semester	4th Semester	5th Semester	6th Semester	7th Semester	8th Semester
1	MATH101 Mathematics I 6 CP (3 UoIL, 3 UoIR)	MATH102 Mathematics II 8 CP (4 UoIL, 4 UoIR)	ENME201 Engineering Mechanics II (Dynamics) 4 CP (2 UoIL, 2 UoIR)	MEAS201 Measurement, Instrumentation and Control Basics 4 CP (2 UoIL, 1 UoIR, 1 UoILab)	RMPE301 Heat and Mass Transfer 4 CP (2 UoIL, 2 UoIR)	RMPE305 Mineral Process Engineering II 6 CP (2 UoIL, 1 UoIR, 1 UoILab 1UoIFt)	RMPE401 Chemical Reaction Engineering 4 CP (2 UoIL, 2 UoIR,)	RMPE404 Process Systems Engineering 8 CP (3 UoIL, 2 UoIR, 1 UoIL)
2								
3								
4								
5			STAT201 Introduction to Statistics 4 CP (2 UoIL, 2 UoIR)	CAD201 Computer Aided Design (CAD) 4 CP (1 UoIL, 3 UoILab)	RMPE302 Mineral Process Engineering I 4 CP (2 UoIL, 1 UoIR, 1 UoILab)			
6								
7	CHEM101 Chemistry 5 CP (3 UoIL, 2 UoIR)					RMPE306 Thermal Unit Operation 6 CP (2 UoIL, 2 UoIR, 1 UoILab)	RMPE402 Hydrometallurgy 6 CP (2 UoIL, 1 UoIR, 1 UoILab, 1 UoIFt)	PROJ401 Final Study Project 6 CP
8								
9		MATS101 Materials Science 4 CP (2 UoIL, 2 UoIR)	THER201 Engineering Thermodynamics 4 CP (2 UoIL, 2 UoIR)	FLME201 Fluid Mechanics 4 CP (2 UoIL, 2 UoIR)	RMPE303 Properties of Rock 4 CP (2 UoIL, 2 UoIR,)			
10								
11								
12	GEOS101 Introduction to Geosciences 4 CP (2 UoIL, 2 UoIR)							
13		ENME101 Engineering Mechanics I (Statics) 4 CP (2 UoIL, 2 UoIR)	DESN201 Engineering Design 4 CP (2 UoIL, 2 UoIR)	RREC201 Raw Materials & Recycling 4 CP (2UoIL, 2UoIFt)	RMPE304 Thermodynamics for Chemical Engineering 4 CP (2 UoIL, 2 UoIR)	EEEJ306 Renewable Energy 4 CP (2 UoIL, 2 UoIR)		
14								
15							RMPE403 Fossil Fuel Technology 4 CP (2 UoIL, 2 UoIR)	
16	PROG101 Algorithms and Programming 4 CP (1 UoIL, 3 UoILab)							
17		PHYS101 Physics 6 CP (1 UoIL, 1 UoIR, 4 UoILab)	ELEC201 Introduction to Electrical Engineering 4 CP (2 UoIL, 2 UoIR)	SCIM201 Scientific Methods 2 CP (2 UoIR)	ENVE304 Introduction to Microbial Biotechnology 4 CP (2 UoIL, 1 UoILab 1UoIFt)	RMPE307 Mining and Environment 4 CP (2 UoIL, 1 UoIR, 1 UoIFt)		THES401 Bachelor Thesis + Colloquium 12 CP
18								
19				HSE201 Health-Safety-Environment 4 CP (2 UoIL, 1 UoIR, 1 UoIIFt)			MECH404 Open Pit and Underground Mining Machines 6 CP (3 UoIL, 1.5 UoIR)	
20	ENSO101 Engineer in Society 2 CP (1 UoIL, 1 UoIR)							
21			MINE201 Introduction to Mining 4 CP (4 UoIL)		Elective 12 CP	INTR301 Industrial Internship + Reflection 10 CP 14 weeks		
22	PROJ101 Engineering Project 2 CP (2 UoIR)							
23		CHEM102 Chemistry Lab 3 CP (UoILab)		LAW201 Law 2 CP (2 UoIL)			STWR401 Scientific Writing 4 CP (2 UoIR)	
24	ENGL101 Technical English 4 CP (4 UoIR)							
25			ECON201 Introduction to Economics 4 CP (2 UoIL, 2 UoIR)	INTR201 Basic Internship 2 CP 6 weeks				
26		BAEM101 Introduction to BA & Engineering Management 4 CP (2 UoIL, 2 UoIR)						
27								
28	INCC101 Intercultural Comm. & Competence 2 CP (2 UoIR)							
29							Elective 6 CP	
30	TIME101 Time Management 2 CP (2 UoIR)	Electives no less than 6 CP						
31								Elective 4 CP
32								
Total CP	**31**	**29**	**28**	**26**	**30**	**30**	**30**	**30**

Legend:							
	CP =	Credit Points	Fundamentals	Specialization	General	Foreign Languages	Internship / Thesis	Electives
	UoI =	Unit of Instruction (45 min. per unit)			UoILab =	Unit of Instruction Laboratory		
	UoIL =	Unit of Instruction Lecture			UoIFt =	Unit of Instruction Field trip		
	UoIR =	Unit of Instruction Recitation						

***Electives: Every 3rd and 4th year student can choose professional engineering modules from the other programs as electives. Presupposed for participation and recognition of the elective module is that the required prerequisites of the chosen elective module already have been passed. Furthermore, the adjustment of the lecture times for attendance**

in the chosen elective modules can only be made by ASA in exceptional cases. The student must choose his/her subjects in such a way that participation in his/her program-related modules is not endangered or restricted.

GENERAL ENGINEERING MODULE (1ST – 4TH SEMESTER)

MATH101 – MATHEMATICS I

Module title	Mathematics I			**Module code**	MATH101
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	6 CP	**Workload**	180 h	**Contact hours**	72 h
				Individual study	108 h
Module coordinator	Prof. L. Altangerel			**Language**	English
Contents	• 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				
Learning outcomes	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**.**				
Literature	1. Stewart J, Clegg D, Watson S. Calculus Early Transcendentals. 9th ed. Boston: Cengage Learning; 2019. 2. Thomas GB, Hass JR, Heil C, Weir MD. Thomas' CALCULUS Early Transcendentals. 14th ed. Boston: Pearson; 2018.. 3. Anton H, Rorres C. Elementary Linear Algebra: Applications Version. 11th ed.: Viley; 2013 4. Rosen KH. Discrete Mathematics and Its Applications. 7th ed. New York: McGraw-Hill; 2012.				
Form of teaching	Lecture (3 UoI) Recitation (3 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 70% and the module examination accounting for 30%.

CHEM101 – CHEMISTRY

<table>
<tr><td>Module title</td><td colspan="3">Chemistry</td><td>Module code</td><td>CHEM101</td></tr>
<tr><td>Duration</td><td>1 semester</td><td>Semester</td><td>Fall</td><td>Module start</td><td>1st</td></tr>
<tr><td rowspan="2">Credit points</td><td rowspan="2">5 CP</td><td rowspan="2">Workload</td><td rowspan="2">150 h</td><td>Contact hours</td><td>60 h</td></tr>
<tr><td>Individual study</td><td>90 h</td></tr>
<tr><td>Module coordinator</td><td colspan="3">J. Bayardulam</td><td>Language</td><td>English</td></tr>
<tr><td>Contents</td><td colspan="5">The students will be introduced chemistry and familiarized with the basic principles and concepts of organic, inorganic and physical chemistry
Introduction of chemistry
The components of Matter; Atomic theory,
Compounds, Formulas, Names & Mass of compounds
The mole, Determining the formula of unknown compound, Writing and balancing chemical equation
Calculating quantities of reactant & products, Fundamentals of solution stoichiometry.
The nature of light, atomic spectra, The Quantum-Mechanical model of the atom
Electron configuration and Chemical periodicity
Atomic properties and chemical bonds, The ionic bonding model, The covalent bonding model, Bond energy and chemical changes
Gas pressure and its measurement, the Gas laws, rearrangement of the ideal gas law
The types of Intermolecular forces, properties of liquid and solids
Enthalpy, Calorimetry, Stoichiometry of thermochemical equation, Hess’s law, Standard enthalpies of reaction
Theories of covalent bonding
Kinetics: The reaction rate, Rate laws, Integrated rate law, Theories of chemical kinetics
Equilibrium: The reaction quotient and equilibrium constant, Expressing equilibria Kc and Kp
Equilibrium: Q & K to determine the reaction direction, Solve the equilibrium problem, Le Chatelier’s principle
Acid-Base equilibria: Acids and bases in water, Autoionization of water, pH scale, Bronsted-Lowry theory, Problem solving weak-acid equilibria
Ionic equilibria: Equilibria of acid-base buffers, Acid-base titration curves, Equilibria of slightly soluble ionic compounds
Thermodynamics: Entropy, Free energy and Direction of chemical reaction
Electrochemistry: Redox reaction
Electrochemistry: Voltaic cells, Electrolytic cells, Cell potential, Nernst equation, electrochemical process in batteries, corrosion
Transition elements and their Coordination compounds, Crystal filed theory
Introduction to organic chemistry: Alkanes, Cycloalkane, Alkenes, Alkynes
The monomer-polymer: Addition polymer, Condensation polymer, Sugar and polysaccharides,
Nuclear chemistry</td></tr>
</table>

Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the atomic structure of chemical elements and chemical bonds of molecules, apply chemical nomenclature to chemical compounds and stoichiometric calculations of the chemical reaction. 2. Use the chemical equilibrium concept in the practical application 3. Interpret the kinetics of chemical reactions and solve kinetics problems. 4. Apply the basic concepts of analytical chemistry in chemical analysis 5. Balance redox reactions, explain the electrochemical reaction, and design and apply electrochemical cells. 6. Apply the acquired basic definitions of thermodynamics in thermodynamic systems. 7. Explain the structure, properties and synthesis of hydrocarbons & and polymers 8. Interpret the basic concepts of nuclear chemistry and solve the nuclear chemical reaction problems. 9. Apply the acquired knowledge, and practice teamwork and presentation skills.
Literature	1. Atkins P, Jones L, Laverman L. Chemical Principles: The quest for insight. 6th ed. Rossignol RB, editor. New York: W. H. Freeman and Company; 2013. 3. Silberberg MS. CHEMISTRY: The Molecular Nature of Matter and Change. 6th ed. Marty Lange JH, editor. New York: McGraw-Hill; 2012. 2. Brown LS, Holme TA. Chemistry for Engineering Students. 2nd ed. Charles Hartford RHAS, editor. Belmont, CA: Brooks/Cole, Cengage Learning; 2011.
Form of teaching	Lecture (3 UoI) Recitation (2 UoI)
Assessment methods	Written examination (120 min.) and academic performance for lecture and recitation
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy & Electrical Engineering B.Sc. Mechatronic Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The grade of chemistry consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%

GEOS101 – INTRODUCTION TO GEOSCIENCE

Module title	Introduction to Geoscience			**Module code**	GEOS101
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. G. Gantuya			**Language**	English
Contents	• 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 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 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 atmosphere Fundamentals of the global atmospheric circulation system, weather and 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, climate change, future climate change scenarios.				
Learning outcomes	I. 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. Recognize important rock types and describe their mineral composition and structure. II. 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, color, 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. 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. Summarize terms measures for the sustainable use of Earth resources in qualitative terms. 7. Recognize relevant ore samples and describe their mineral composition and structure. IV. Earth's atmosphere On successful completion of this module, the students should be able to: 1. Identify weather and climate elements 2. Recognize monitoring tools of weather elements 3. Recall the fundamentals of the global atmospheric circulation system 4. Clarify past, current, and future climate scenarios.
Literature	1. Klein C, Philpotts AR. Earth Materials: Introduction to Mineralogy and Petrology New York: Cambridge University Press; 2012. 2. Mukherjee S. Applied Mineralogy: Applications in Industry and Environment New York: Capital Publishing Company; 2011. 3. Kresan PL, Mencke R. Student study guide for UNDERSTANDING EARTH. 6th ed. New York: W. H. Freeman and Company; 2010. 4. Wnek HR, Bulakh A. Minerals: Their Constitutions and Origin United Kingdom: Cambridge University Press; 2004. 5. Hamblin WK, Christiansen EH. Earth's Dynamic Systems. 10th ed.; 2004. 6. Evans AM. Ore Geology and Industrial Minerals: An Introduction. 3rd ed. Hallam A, editor.: Blackwell Publishing; 1993.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment method	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 B.Sc. Energy and Electrical Engineering

	B.Sc. Mechatronic 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 60% and the module examination accounting for 40%.

PROG101 – ALGORITHMS AND PROGRAMMING

Module title	Algorithms and Programming			**Module code**	PROG101
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Kh. Uyanga			**Language**	English
Contents	• Introduction of Programming Languages (, history of C programming language, syntax, programming process, structure, executing and debugging); • Programming Methodologies (concepts of algorithm design, flowcharts and pseudo codes, number systems) • Structured language (keywords, identifiers, declarations, operators, constants, variables, data types (integer, floating-point data), library functions) • Control Statement and Expressions (statements (if, if … else, switch, goto), arithmetic expressions) • Looping (for, while, do while, jumping, break and continue) • Arrays (one, two, multidimensional) and string (variables and functions) • Functions and Program Structure (C: user-defined and system defined; • File Processing, discipline of programming.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Implement a variety of algorithms for searching and sorting, including linear search, binary search, insertion sort, selection sort, merge sort, quicksort, and heap sort. 2. Describe abstract data types used in C/C++ and explain their usage 3. describe commonly used syntactic constructions used in C/C++ 4. Develop programs and application 5. Apply knowledge in major courses and practical 6. Solve problems 7. Work independently				
Literature	1. Hanly JR, Koffman EB. Problem Solving and Program Design in C. 8th ed. Essex: Pearson Education Limited; 2016. 2. Deitel P, Deitel H. C How to Program. 6th ed. Horton MJ, editor. New Jersey: Pearson Education, Inc.; 2010. 3. Kernighan BW, Ritchie DM. C Programming Language. 2nd ed. New Jersey: Prentice-Hall, Inc; 1988.				
Form of teaching	Lecture (1 UoI) Laboratory (3 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 50% and the module examination accounting for 50%.

ENSO101 – ENGINEER IN SOCIETY (ETHICS)

Module title	Engineer in Society (Ethics)			**Module code**	ENSO101
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	Prof. B. Battsengel			**Language**	English
Contents	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 recognize the relevance for their profession. 2. Think critically about the role of the engineers in the society. 3. Recognize the ethical responsibility of the engineers in concrete situations and analyze 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	1. Martin MW. Introduction to Engineering Ethics. 2nd ed. Debra B. Hash DMS, editor. New York: McGraw-Hill; 2010. 2. Lawlor R. Engineering in Society Lawlor R, editor.; 2004. 3. Rees M. Our final hour: A scientist's warning: How terror, error, and environmental disaster threaten humankind's future in this century - on Earth and beyond New York: Basic Books; 2003.				
Form of teaching	Lecture (1 UoI) Recitation (1 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				

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

PROJ101 – ENGINEERING PROJECT

Module title	Engineering Project			**Module code**	PROJ101
Duration	1 week + report	**Semester**	Fall	**Module start**	1st
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	Prof. N. Battulga			**Language**	English
Contents	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 analyze 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 (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	None				
Requirements for receiving credit points	Passing the module				
Grading system	Pass/ Fail				

ENGL101 – TECHNICAL ENGLISH

Module title	Technical English			**Module code**	ENGL101
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Robin Charpentier			**Language**	English
Contents	• General vs Technical English; Latin and Greek Roots • Geotechnology • Properties of Metals • Material Formats • Plastics, Elasticity • Ceramics, Glass, Wood • Precision, Accuracy in Measurements, Safety • MID-TERM EXAM • Process Engineering • Fluid Dynamics, Architectural Drawings/Design • Electricity and Magnetism • Math, Statistics, Graphs, Data Ethics • Invention/Innovation/ Spinoffs • Sustainability; the Circular Economy • Presentation Topic Approval; About Infographics, Poster Sessions • Final Presentations – Poster Session (Infographics)				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Demonstrate understanding of, and properly express/describe STEM – related: abbreviations, root meanings, and definitions of symbols, words, and phrases; graphs and the behavior of lines; equations; and simple technical processes, using appropriate terminology and structures 2. Read short texts on a broad range of STEM – related topics at an intermediate to high-intermediate level, in order to understand some technical details and identify the core meanings, and summarize the information in their own words 3. Follow and grasp the main points in a lecture, including audio-visual material at an intermediate to high-intermediate level, on a broad range of topics in STEM – related fields 4. Effectively communicate both orally and in writing on a broad range of STEM – related topics, in English, using relevant stylistic structures				
Literature	1. Barbara A. Cornelen Campus: Englsih for Mechanical Engineering. B2 Coursebook: Cornelsen; 2011. 2. Supplementary materials related to topics covered				

Form of teaching	Recitation (4 UoI)
Assessment method	(70%) = Written final examination (30%) = Active in-class participation (15%); tests, mid-term exam, final oral presentation [poster session] (15%)
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering
Prerequisites for participation	• English at the C1 level in all 4 skills • Have an expressed interest in engineering as their major
Requirements for receiving credit points	• Attendance is recorded for those arriving before the scheduled start time • Students must attend at least 80% of the classes in this to be eligible to sit for the Final Exam • Participation means: volunteering answers; asking and/or responding to questions; paying attention; actively focusing on in-class tasks; turning in assignments on time and with good quality
Grading system	The modes of assessment total 100%

INCC101 – INTRODUCTION TO INTERCULTURAL COMMUNICATION AND COMPETENCE

Module title	Introduction to Intercultural Communication and Competence			**Module code**	INCC101
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	Robin Charpentier			**Language**	English
Contents	• Elements and Definitions of Culture • Identity: Scale, Boundaries, Aspirational, Ascriptive • Theories and Models of Culture • Shared vs Unique Aspects of Identity • Cultural Awareness • Communication Types – Identification and Practice • Direct/Indirect Communication in Different Cultures • What do we Need to Know About Them? • Mid-Term Exam • Stereotypes, Prejudice • Conscious/Unconscious Bias • Exploring Communications Approaches - Models • Meyers-Briggs Type Indicators • Cultural Awareness Levels; • Stages of Cultural Adjustment • Case Studies: Analyzing Critical Incidents				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Understand their own cultural background and values, and their importance in dealing successfully with people from other cultures 2. Recognize sensitive cultural particularities, and try to respond to these differences in an appropriate and tactful manner 3. Analyze, post hoc, intercultural incidents that have occurred and develop problem solving strategies for future such cases				
Literature	1. Glaser E, Guilherme M, Garcia MCM, Mughan T. Intercultural Competence for Professional Mobility: Council of Europe Publishing; 2007. 2. Bennett MJ. Basic Concepts of Intercultural Communication: Paradigms, principles, and practices. 2nd ed. Boston: Intecultural Press; 1998.				
Form of teaching	Recitation (2 UoI)				
Assessment method	(70%) = Written final examination (30%) = Active in-class participation (15%); turning in assignments on time and with good quality, mid-term exam (15%)				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering				

	B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering
Prerequisites for participation	English at the C1 level in all 4 skills
Requirements for receiving credit points	• Attendance is recorded for those arriving before the scheduled start time • Students must attend at least 80% of the classes in this to be eligible to sit for the Final Exam • Participation means: volunteering answers; asking and/or responding to questions; paying attention; actively focusing on in-class tasks; turning in assignments on time and with good quality
Grading system	The modes of assessment total 100%

TIME101 – TIME MANAGEMENT

Module title	Time Management			**Module code**	TIME101
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	Prof. Sungchil Lee			**Language**	English
Contents	The students will learn time management skills and self-development skills. • Time management for successful school life • Shaping thinking frame • Values & purpose of life • Prioritizing tasks • Systematic management of tasks • Objective management • Reading & study skills for enhancing intelligent capacity				
Learning outcomes	On successful completion of this module, students should be able to: 1. Recognize the need of time management in their life. 2. Identify greatest time wasters and avoid them 3. Apply time management skills for effective school life. 4. Prioritize and organize tasks systematically. 5. Develop and align their long- and short-term objectives along with life-goals. 6. Motivates themselves for study at GMIT. 7. Apply reading and thinking skills for their study.				
Literature	1. Forsyth P. 100 Great Time Management Ideas from successful executives and managers around the world Singapore: Marshall Cavendish; 2009. 2. Handbook on Time Management Skills for Public Managers: Centre for Good Governance; 2009. 3. Mancini M. Time Management: McGraw-Hill; 2003.				
Form of teaching	Lecture & workshop (2 UoI)				
Assessment method	Active participation, individual & group presentation, homework				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	None				

Requirements for receiving credit points	Passing the thesis and the presentation
Grading system	Pass/Fail

MATH102 – MATHEMATICS II

Module title	Mathematics II			**Module code**	MATH102
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	8 CP	**Workload**	240 h	**Contact hours**	96 h
				Individual study	144 h
Module coordinator	Prof. L. Altangerel			**Language**	English
Contents	• Series: numerical series, power series, 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 • Basics of ordinary and partial differential equations: modelling using differential equations, first and second order ordinary differential equations, system of ordinary differential equations, basic concepts of partial differential equations.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Demonstrate and apply the basic concepts of series; 2. Explain and calculate differential and calculus of functions of several variables. Be aware of their connections and potential applications in other fields. 3. Demonstrate and apply the basic concepts of ordinary and partial differential equations; 4. Make use of mathematical models to solve complex scientific and engineering problems .				
Literature	1. Stewart J, Clegg DK, Watson S. Solutions Manuals for Calculus Early Transcendentals. 9th ed.: -Cengage Learning ; 2020. 2. Thomas GB, Hass J, Heil C. Thomas' CALCULUS Early Transcendentals. 14th ed. Weidenaar J, editor.: Pearson; 2018. 3. Nagle RK, Saff EB, Snider AD. Fundamentals of Differential Equations. 9th ed. Weidenaar J, editor.: Pearson Education, Inc.; 2018.				
Form of teaching	Lecture (4 UoI) Recitation (4 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 70% and the module examination accounting for 30%.

MATS101 – MATERIALS SCIENCE

Module title	Materials Science			**Module code**	MATS101
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	R. Nyamdulam			**Language**	English
Contents	• Introduction to Interatomic bonding Attractive and repulsive forces; Primary bonding, secondary bonding, and Van der Waals bonding • Introduction to Crystal Structures Crystalline and amorphous structures; single crystalline and polycrystalline materials, and crystal systems • Imperfection in Solids Chemical impurity; solid solution, point defect, linear defect, planar defect, volume defect • Mechanical properties Engineering stress, and engineering strain; Hooke's Law; Destructive, and Non-destructive testing techniques • Thermal behavior Heat capacity; Thermal expansion; Thermal conductivity, thermal shock • Phase Diagrams/ Phase Transformations Various phase regions; Compositions of phases; Binary phase equilibrium; Heat treatment processes; Kinetics of Phase transformation • Structural Materials Organic (Polymers and Composites) and Inorganic (Metals, Ceramics and glasses) materials, and their application • Electrical properties and Electronic Materials Conducting materials, insulators, semiconductors, and their application • Optical properties and Materials • Magnetic properties and Materials • Social and Environmental impact				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe the connection between atomic structure, and identify different types of crystal structures. 2. Describe the impacts of defects at the atomic and microstructure scales 3. Explain thermally activated processes, 4. Explain the significance of the main mechanical properties in relation to component design. 5. Explain the fundamentals of non-destructive testing. 6. Select materials in a responsible manner.				

	7. recognize and apply the significant properties for mechanically characterizing materials. 8. Explain diffusion processes. 9. Interpret states of phase equilibrium and non-equilibrium, understand the concepts of solid solution and solubility limits, and be able to define microscopic properties using the example of eutectic phase diagram. 10. Explain the qualities and quantifications of mechanical, thermal, electrical, optical, magnetic, and chemical properties.
Literature	1. Shackelford JF. Introduction to MATERIALS SCIENCE FOR ENGINEERS. 8th ed. Stark H, editor. New Jersey: Pearson Higher Education, Inc; 2015. 2. Callister WD, Rethwisch DG. Materials Science and Engineering: An Introduction. 9th ed. Sayre D, editor. New Jersey: Wiley; 2000. 3. Anderson JC, Leaver KD, Rawlings RD, Alexander JM. Materials Science. 4th ed. Singapore: Springer-Science+Business Media, B.V.; 1990.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering
Prerequisites for participation	Knowledge of the modules Chemistry and Physics
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%.

ENME101 – ENGINEERING MECHANICS I (STATICS)

Module title	Engineering Mechanics I (Statics)			**Module code**	ENME101
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. Sungchil Lee			**Language**	English
Contents	General systems of forces. Equilibrium of rigid body. Reaction forces at structural supports. Moment by forces. Structural analysis of truss, beams, frame structures. Center of mass, area, volume. Virtual work principle. Friction. Stability of column structure.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the concept of force, moment, and equilibrium state in Statics. 2. Establish equilibrium equations and solve statically determinate structures. 3. Compute support reaction forces in statically determinate systems by means of equilibrium conditions or the principle of virtual work. 4. Compute internal forces in beam and truss structures and discuss the effects of external forces on structures. 5. Use shear force diagram and bending moment diagram to interpret the effect of external forces on structures. 6. Compute the center of mass, volume, and area. 7. Apply Pappus principle to calculate volume and surface area of revolving objects. 8. Classify friction type in simple machines and compute proper friction forces.				
Literature	1. Gross D, Hauger W, Schroder J, Wall WA, Rajapakse N. Engineering Mechanics 1 Statics: Solutions to Supplementary Problems. 2nd ed.; 2012. 2. Meriam JL, Kraige LG. Engineering Mechanics Volume 1 Statics. 7th ed. Hoboken, NJ: John Wiley & Sons, Inc.; 2012.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.

PHYS101 – PHYSICS

Module title	Physics			**Module code**	PHYS101
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	6 CP	**Workload**	180 h	**Contact hours**	72 h
				Individual study	108 h
Module coordinator	Prof. N. Battulga			**Language**	English
Contents	**Statics:** • Vector operations, Torque **Kinematics:** • projectile motion, uniform circular motion, centripetal acceleration **Dynamics:** • Newton's Laws and their applications, principle of conservation of momentum **Energy and Work:** • Kinetic and Potential energy, Conservation of Energy **Fluid mechanics:** • Fluid Properties, Fluid flows **Electricity:** • Electric field of a point charge, Electric potential, Capacitors and capacitance, Electric current, Potential difference, Resistance and resistivity **Oscillations**: • Simple harmonic motion, Energy in simple harmonic motion				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Demonstrate vector operations, torque, Newton's Laws, conservation of momentum and energy in various practical problems. 2. Determine different types of fluid flows, and fluid properties 3. Calculate the electric potential, eapacitors and capacitance, electric current, potential difference, resistance and resistivity. 4. Demonstrate simple harmonic motion, and related energy in various practical problems				
Literature	1. Young HD, Freedman RA. University Physics with Modern Physics. 14th ed.: Pearson Education; 2015. 2. Walker J. Fundamentals of physics. 10th ed. Hoboken, NJ: John Wiley and Sons, Inc.; 2014. 3. Wilson JD, Hernández-Hall CA. Physics Laboratory Experiments. 8th ed.: Brooks Cole; 2014. 4. Serway RA, Jewett JW. Physics for Scientists and Engineers with Modern Physics. 9th ed.: Cengage Learning; 2013.				
Form of teaching	Lecture (1 UoI) Recitation (1 UoI) Laboratory (4 UoI)				
Assessment method	Written examination (60 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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering
Prerequisites for participation	Completion of Mathematics I recommended.
Requirements for receiving credit points	Passing the module “Physics laboratory” is a prerequisite for the participation of the final module examination
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

CHEM102 – CHEMISTRY LABORATORY

Module title	Chemistry Laboratory			**Module code**	CHEM102
Duration	1 semester	**Semester**	Spring	**Module-start**	2nd
Credit points	3 CP	**Workload**	90 h	**Contact hours**	36 h
				Individual study	54 h
Module coordinator	J. Bayardulam			**Language**	English
Contents	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> ● Properties of matter – boiling point ● Reaction of magnesium and calcium with water – hydroxide ● Quantitative analysis of oxides and properties of mixture ● Formation of salts by reaction of metals with acids ● Detection of an acidic reaction with various indicators ● Estimation of copper by colorimetric method ● Electrolysis of water ● Rate of chemical reaction ● Electrochemical cell ● Observing Chemical Equilibrium ● Precipitates and Solubility Rules ● Hess's law				
Learning outcomes	On successful completion of this module, the students should be able to: 1. apply simple working procedures in the laboratory. 2. Determine physical and safety-related data for materials, and interpret it in context. 3. use experimental equipment in accordance with the safety regulations, and carry out experiments. 4. work together in small groups. 5. prepare a technical report on an experiment and present the results of the experiment in a suitable form. 6. use technical terms and expressions in English .				
Literature	1. Allan BJ. Laboratory Manual for Principles of General Chemistry. 10th ed.: Wiley; 2014. 2. Atkins JL. Chemical Principles. 6th ed.: W.H. Freeman and Company; 2013. 3. Brown L, Holme T. Chemistry for Engineering Students. 2nd ed.: Brooks Cole; 2010.				
Form of teaching	Laboratory (3 UoI)				

Assessment methods	Pre-lab questions before conducting lab experiments, and post-lab defense and written documentation (lab reports) after the experiment. Midterm exams after completing 6 modules each.
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy & Electrical Engineering B.Sc. Mechatronic Engineering
Prerequisites for participation	None
Requirements for receiving credit points	Passing the module
Grading system	The Lab grade consists of the lab performance (including prelab, participation in experiments and lab report defense) during the module accounting for 70% and the final examination accounting for 30%

BAEM101 – INTRODUCTION TO BUSINESS ADMINISTRATION AND ENGINEERING MANAGEMENT

Module title	Introduction to Business Administration and Engineering Management			**Module code**	BAEM101
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. Ch. Enkhzaya			**Language**	English
Contents	Students will be introduced to basic principles of business administration. In addition, the module prepares students for courses to come in engineering management. Business administration studies problems within the firm and relates to problems in the fields of production organization, strategy, marketing and logistics, finance and accounting, and information management: • History and state of the art of business administration as a discipline (fundamentals, managing, and performing, technology-driven management) • Why do firms exist? (causes and goals of firms, the structure of a firm, business environment) • How to manage processes, teams and firms? • Constitutive decisions • Production • Basics of marketing and sales • Investment and Financing • Business Accounting • Managerial communication Additionally, the Module should enable the students to understand the specifics of the private sector - function and structure - in Mongolia				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Remember and understand what is this discipline about. 2. Describe the boundaries of the discipline towards other disciplines like e.g. macro economy or natural sciences 3. Explain the principles on which firms exist and make decisions 4. Identify various fields of the firm's activities 5. Understand the legal environment in which firms operate 6. Analyze core functions of firms by breaking them into constituent parts (purchase, production, sales and marketing, HR, operations and controlling, etc.), and by determining how the parts relate to one another 7. Evaluate the performance of firms according to criteria and standards 8. Develop or create solutions for general managerial tasks				
Literature	1. Wöhe. Einführung in die Allgemeine Betriebswirtschaftslehre. 27th ed.: Vahlen, Munich; 2020.				

	2. Bauer T, Erdogan B, Short J. Principles of Management v. 4.0: Boston Academic Publishing; 2019. 3. Robbins SP, Coulter M. Management. 11th ed.: Pearson; 2012.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment method	Written examination (90 min) – optimally based on a case study from the technology world; and academic performance (report and oral presentation and attendance)
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 accounted for 30% (incl. term paper and midterm exam) and the module examination accounted for 70%

ENME201 – ENGINEERING MECHANICS II (DYNAMICS)

Module title	Engineering Mechanics II (Dynamics)			**Module code**	ENME201
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. Sungchil Lee			**Language**	English
Contents	Kinematics of particles and rigid body. Coordinate systems in Dynamics. Physical quantities in various coordinate systems. Projectile motion. Kinetics of particles and rigid bodies. Work and energy of particle and rigid body. Linear momentum and impulse of particle and rigid body. Angular momentum and impulse of rigid body.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe planar and spatial motions of particle and rigid bodies using coordinate systems. 2. Formulate dynamic problems into equation of motion applying the Newton´s law of motion. 3. Calculate acceleration, velocity of moving objects applying work and energy concept. 4. Calculate motion of rigid body applying angular momentum and impulse. 5. Integrate the principles of Dynamics and Statics to formulate engineering problems. 6. Distinguish the difference between linear and angular momentum and impulse theory and solve dynamic problems.				
Literature	1. Gross D, Hauger W, Schröder J, Wolfgang A. Wall, Sanjay Govindjee. Engineering Mechanics 3: Dynamics. 2nd ed.: Springer-Verlag Berlin Heidelberg; 2014. 2. Kraige LG, Meriam JL. Dynamics. 7th ed.: Wiley; 2013.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.				

STAT201 – INTRODUCTION TO STATISTICS

Module title	Introduction to Statistics			**Module code**	STAT201
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	G. Dorjsundui			**Language**	English
Contents	The module has two strongly related parts as probability and statistics. The first part covers an introduction to probability and random variables. Topics include distribution functions, binomial, geometric, hypergeometric, and Poisson distributions. The other topics covered are uniform, exponential, normal, gamma and beta distributions; conditional probability; Bayes theorem; joint distributions; law of large numbers; and central limit theorem. The second part offers an in-depth theoretical and practical foundation for statistical methods that are useful in many applications. The goal is to understand the role of statistical thinking in the engineering field				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Have fundamental approaches of probability calculation and conceptual definitions. 2. Set up and work with discrete and continuous random variables. In particular, understand the Bernoulli, binomial, geometric, Poisson distributions, uniform, normal and exponential distributions. 3. Know what expectation and variance mean and be able to compute them and extend the convergence of statistical inference. 4. Explain and interpret the quantitative data as descriptive statistical results including tables and graphs. 5. Understand the difference between probability and likelihood functions, and find the maximum likelihood estimate for a model parameter with basic confidence intervals. 6. Demonstrate null hypothesis significance testing to test the significance of results, and understand and compute the p-value for these tests. 7. Compute and interpret simple linear regression between two variables .				
Literature	1. Mario TF. Elementary Statistics. 13th ed.: Pearson; 2018. 2. Moonjung C, Wendy ML. Statistics in MATLAB: A Primer: CRC Press; 2014. 3. Walpole RE, Myers RH, Myers Sl, Ye KE. Probability and Statistics for Engineers and Scientists. 9th ed.: Pearson; 2012. 4. Ott L, Longnecker M. An Introduction to Statistical Methods and Data Analysis. 6th ed.: Brooks/Cole; 2010. 5. Navidi W. Statistics for Engineers and Scientists . 3rd ed.: McGraw-Hill Science/Engineering/Math; 2010. 6. Ross S. A First Course in Probability . 8th ed.: Pearson Prentice Hall; 2009. 7. Bertsekas DP, Tsitsiklis JN. Introduction to Probability: MIT; 2000.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				

Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering
Prerequisites for participation	Mathematics II
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 70% and the module examination accounting for 30%.

THER201 – ENGINEERING THERMODYNAMICS

Module title	Engineering Thermodynamics			**Module code**	THER201
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. B. Battsengel			**Language**	English
Contents	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; thermodynamics 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 behavior. 2. Distinguish between different types of energy (e.g. work, heat, internal energy and enthalpy) and define them. 3. Analyze technical systems and processes using energy balances and equations of state. 4. Assess energy conversion processes by means of an exergy analysis. 5. Characterize the thermal behavior 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	1. Koretsky MD. Engineering and Chemical Thermodynamics. 2nd ed.: Wiley; 2012. 2. Çengel YA, Boles MA. Thermodynamics: An Engineering Approach. 8th ed.: McGraw-Hill Education; 2011.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.

DESN201 – ENGINEERING DESIGN

Module title	Engineering Design			**Module code**	DESN201
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. Sungchil Lee			**Language**	English
Contents	Drawing letters and numbers. Drawing polygon and ellipse. Isometric projection. Orthographic projection. Perspective projection. Oblique projection. Dimensions. Gears and Cams. Tolerance. Geometric tolerance. Mechanical design concept.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Draw alphabets and numbers following the engineering drawing custom. 2. Draw bisect line, perpendicular line, bisect angle line. 3. Make drawings of objects using isometric projection, orthographic projection, oblique projection, and perspective projection. 4. Interpret drawings of multi-view projection of objects and draw them using isometric projection. 5. Draw cam profile based on the cam drawing. 6. Explain gear parts and calculate gear shape. 7. Interpret and make tolerance drawing and geometric tolerance drawing. 8. Model mechanical drawing of parts.				
Literature	1. Giesecke et al. Technical drawings with engineering graphics. 14th ed.: Pearson; 2014. 2. Mott RL. Machine Elements in Mechanical Design. 4th ed.: Prentice Hall; 2004.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.

ELEC201 – INTRODUCTION TO ELECTRICAL ENGINEERING

Module title	Introduction to Electrical Engineering			**Module code**	ELEC201
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. P. Ariunbolor			**Language**	English
Contents	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, self-inductance, 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. Analyze and calculate simple linear AC circuits. 5. Design simple electronic circuits 6. Apply the knowledge of electric safety.				
Literature	1. Theraja BL, Theraja AK. A Textbook of Electrical Technology in SI Units. Volume I: Basic Electrical Engineering: S Chand & Co Ltd; 1999. 2. Cathey JJ, Nasar SA. Schaum's Outline Series Theory and Problems of Basic Electrical Engineering: McGraw-Hill; 1983.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (90 min.) and oral examination for documentation and presentation (10-30 min. per each student				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.				

MINE201 – INTRODUCTION TO MINING

Module title	Introduction to Mining			**Module code**	MINE201
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. T. Hollenberg			**Language**	English
Contents	The course aims to support students in acquiring the knowledge about extraction of raw materials and the influence of the mining industry on the development of resource rich countries through mining, processing and value adding. • Market economics • Prospection and Exploration, Deposit assessment • Ground mechanics • Equipment Selection and Requirements • Mining method selection • Surface Opening and Development • Surface Ore Handling Techniques • Surface Mining Operations and Variations • Underground Development • Underground Ore Handling Techniques • Underground Mining Operations and Variations • Hydraulic and Pipeline Mining • Shallow and Deep Drilling • Mineral processing • Mining and Environment • Community and social issues				
Learning outcomes	Upon successful completion of this module, students will, through assessment activities, show evidence of their ability to: 1. Analyze different raw material deposits and evaluate the economic value. 2. Identify the principles of the technologies and apply selection methods for mining operations. 3. Plan and design mining operations and choose appropriate technologies for given circumstances. 4. Recognize the machines and technologies used in open pit and underground mining. 5. Calculate the main parameters of simple technological chains .				
Literature	1. Kuchta HWA, Martin M, Randall K. Open Pit Mine Planning and Design, Two Volume Set & CD-ROM Pack, Third Edition. 3rd ed.: CRC Press; 2013. 2. Peter D. SME mining engineering handbook. 3rd ed.: Society for Mining, Metallurgy, and Exploration; 2011. 3. Milojcic G, Asmus SC, Thielemann T, Ernst H. Christian Niemann-Delius, Rolf Dieter Stoll, Carsten Drebenstedt, Klaus Müllensiefen. Der Braunkohlentagebau: Bedeutung, Planung, Betrieb, Technik, Umwelt. 1st ed.: Springer-Verlag Berlin Heidelberg; 2009. 4. Howard HL. Introductory Mining Engineering. 2nd ed.: Wiley; 2007.				
Form of teaching	Lecture (4 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.

ECON201 – INTRODUCTION TO ECONOMICS

Module title	Introduction to Economics			**Module code**	ECON201
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Dr. P. Bolormaa			**Language**	English
Contents	This module 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 labor 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 influence 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	1. Parkin M. Economics. 12th ed.: Pearson; 2015. 2. Mankiw NG. Principles of Economics. 7th ed.: Cengage Learning; 2014. 3. Atkinson B, Miller R. Business Economics: Addison Wesley; 1998.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.

MEAS201 – MEASUREMENT, INSTRUMENTATION AND CONTROL BASICS

Module title	Measurement, Instrumentation and Control Basics			**Module code**	MEAS201
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. P. Ariunbolor			**Language**	English
Contents	• 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 programs • 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 recognize 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 optimizing automation equipment and evaluate existing automation systems.				
Literature	1. Rossi GB. Measurement and Probability: A Probabilistic Theory of Measurement with Applications : Springer; 2014. 2. Rossi GB, Huang S, Wang S. Springer Series in Measurement Science and Technology: Springer; 2014. 3. Hebra A. The Physics of Metrology: Springer; 2010. 4. Kimothi SK. Uncertainty of Measurements: Physical and Chemical Metrology. 1st ed.: Asq Pr; 2002. 5. Pennella CR. Managing the Metrology System. 2nd ed.: Amer Society for Quality; 1997.				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI)				
Assessment method	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				

	B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.

CAD201 – COMPUTER AIDED DESIGN (CAD)

Module title	Computer Aided Design (CAD)			**Module code**	CAD201
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. Sungchil Lee			**Language**	English
Contents	Development of CAD software. Environment of AutoCAD. Basic drawing commands: line, circle, polygon, etc. Modification commands: copy, move, trim, extends, join, break, array, insert, etc. Text commands. Miscellaneous commands. Dimensions. Geometric tolerance. Hatching. Layers. Blocks. Drawing mechanical parts. Drawing multi-view projections of object. Design mechanical parts.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Draw basic geometrics: line, circle, rectangle, etc. 2. Edit drawings using modification commands. 3. Apply each line style appropriately in drawings. 4. Draw dimensions and modify existing dimensions. 5. Interpret and make general tolerance and geometric tolerance 6. Utilize layers to draw efficiently. 7. Make and save blocks and utilize them in drawing. 8. Criticize mechanical drawings.				
Literature	1. Dix M, Riley P. Discovering AutoCAD. 1st ed.: Pearson; 2015. 2. Lang K. AutoCAD Tutor for Engineering Graphics. 1st ed.: Cengage Learning; 2013.				
Form of teaching	Lecture (1 UoI) Laboratory (3 UoI)				
Assessment method	Drawing using AutoCAD software (30 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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.				

FLME201 – FLUID MECHANICS

Module title	Fluid Mechanics			**Module code**	FLME201
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. N. Battulga			**Language**	English
Contents	• Basic concepts in fluid mechanics, such as continuum, velocity field, and vorticity. • Dimensional analysis • Principle of the mass conservation and the Newton's law to describe the fluid motion and solve basic engineering problems. • Fluid motion for inviscid fluids, internal flows (e.g. pipe flows), external flows (airfoils and bluff bodies), and flows with a free surface.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Calculate fluid flow regimes, including laminar vs turbulent flows; boundary layers and velocity profiles; 2. Apply Dimensional Analysis techniques; 3. Compute basic hydrostatics problems involving manometers and submerged surfaces. 4. Demonstrate the concept of continuity, 5. Demonstrate Bernoulli's principle, and apply it in flow measurement (orifice and Venturi meter, Pitot-static tube), and to a variety of problems involving area change and height change. 6. Solve basic problems involving pressure losses through pipes and pipe bends and fittings. 7. Apply Momentum equation and the concept of a control volume. Use the equation to calculate impulse and reaction forces due to the interaction of a fluid stream with objects, and pressure drops.				
Literature	1. Elger DF, Crowe CT , Roberson JA, Williams BC. Engineering Fluid Mechanics. 10th ed.: Wiley; 2012.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	PHY101, THER220,				

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%.

RREC201 – RAW MATERIALS AND RECYCLING

Module title	Raw Materials and Recycling			**Module code**	RREC201
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Dr. T. Narangarav			**Language**	English
Contents	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	1. Pichtel J. Waste Management Practices: Municipal, Hazardous, and Industrial. 2nd ed.: CRC Press; 2014. 2. Bilitewski B, Härdtle G, Marek K. Waste Management. 1st ed.: Springer; 2010. 3. Bagchi A. Design of Landfills and Integrated Solid Waste Management. 2nd ed.: Wiley; 2004. 4. Rowe DR, Abdel-Magid IM. Handbook of Wastewater Reclamation and Reuse. 1st ed.: CRC Press; 1995.				
Form of teaching	Lecture (2 UoI) Recitation/Field trip (2 UoI))				
Assessment method	Written examination (60 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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 50% and the module examination accounting for 50%.

SCIM201 – SCIENTIFIC METHODS

Module title	Scientific Methods			**Module code**	SCIM201
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	Prof. L. Altangerel			**Language**	English
Contents	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 analyzing 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, 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	1. Deb D, Dey R, Balas WE. Engineering Research Methodology. 1st ed.: Springer; 2019. 2. Ormrod LPD, Ellis J. Practical research : planning and design. 11th ed.: Pearson; 2015. 3. Kumar R. Research Methodology. 3rd ed.: SAGE Publications; 2010.				
Form of teaching	Recitation (2 UoI)				
Assessment method	Academic performance and final presentation, report				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering				

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

HSE201 – HEALTH SAFETY ENVIRONMENT (HSE)

Module title	Health Safety Environment (HSE)			**Module code**	HSE201
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	B. Erdenebaatar			**Language**	English
Contents	• 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, organization and human behavior; 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) • 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 behavior, 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, 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. Analyze complex work systems in terms of the causal chain (cause-effect-damage) and select protective measures. 4. Describe the structure, Contents and goals of the main HSE management systems, describe the duties of the technical and managerial personnel in terms of analysis, organization and activities				
Literature	1. Center for the Advancement of Process. Safety, Health & Environment: Prentice Hal; 2009.				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Field trip (1 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.

LAW201 – LAW

Module title	Law			**Module code**	LAW201
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	G. Surakhbayar			**Language**	English
Contents	This module introduces students to the basics of national and international environmental law. Including: • Overview of Environmental Concepts, Theories, Sources; • Protecting Environmental Objects such as Air, Water, and Wildlife in Mongolia • International Environmental Norms				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe the roles of contemporary theories, concepts, and sources concerning environmental protection. 2. Examine the importance of environmental laws & regulations and its application within the Mongolian court system. 3. Assess interactions between environmental laws & regulations and other domestic laws. 4. Apply environmental rules and norms to specific environmental issues in Mongolia.				
Literature	1. Amarkhuu O. Contemporary Environmental Law of Mongolia; 2013. 2. Percival RV, Schroeder CH, Miller AS, James P. Leape. Environmental Regulation: Law, Science, and Policy. 7th ed.: Wolters Kluwer; 2013. 3. Hunter D, Salzman J, Zaelke D. International Environmental Law and Policy. 4th ed.: Foundation Press; 2010.				
Form of teaching	Lecture (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%.				

INTR201 – BASIC INTERNSHIP

Module title	Basic Internship			**Module code**	INTR201
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	2 CP	**Workload**	120 h	**Contact hours**	NA
				Individual study	120 h
Module coordinator	Department of Academic and Student Affairs			**Language**	English
Contents	During the internship, students will be introduced to the social structures in the company, work processes, the relationship between employees, supervisors and executives, and teamwork as well as the responsibility of the individual employee. The Basic Internship helps the students to decide on a major or confirm the decision they have already made.				
Learning outcomes	After taking part in the industrial placement, the student should be able to: 1. Explain the company structure and its work processes. 2. Describe the duties and tasks of positions in the company. 3. Do simple SWAT analysis for the company. 4. Provide a written statement of the activities carried out, an appropriately record their observations and experiences.				
Literature	None				
Form of teaching	Basic internship (6 weeks)				
Assessment method	Written report (min. 10 p.)				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	None				
Requirements for receiving credit points	Confirmation of participation in the internship, Acceptance of the written report.				
Grading system	Pass / Fail				

PROFESSIONAL MODULES (5TH – 8TH SEMESTER)

RMPE301 – HEAT AND MASS TRANSFER

Module title	Heat and Mass Transfer			**Module code**	RMPE301
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. N. Battulga			**Language**	English
Contents	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 described 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	1. Baehr HD, Stephan K. Heat and mass transfer, Springer, 3rd. ed; 2011.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (120 min.) and academic performance.				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	Completion of 1-4 semester				
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%.				

RMPE302 – MINERAL PROCESS ENGINEERING I

Module title	Mineral Process Engineering I + Process Mineralogy			**Module code**	RMPE302
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	B. Myagmarjav			**Language**	English
Contents	• 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	2. AT Mineral Processing Journal. 3. Wills BA. Mineral Processing Technology, 4th edition, Pergamon Pres, Oxford; 1988. 4. Weiss NL. SME Mineral Processing Handbook, New York: Society of Mining Engineers; 1985.				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI)				
Assessment method	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	Completion of semester 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 60% and the module examination accounting for 40%.				

RMPE303 – PROPERTIES OF ROCK

Module title	Properties of Rock			**Module code**	RMPE303
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	E. Baljinnyam			**Language**	English
Contents	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 Contents, sources, hardness, abrasiveness), and description of the testing techniques for hard rocks (hydro-thermo-mechanically coupled tests, non-destructive testing techniques, Contents/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 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	1. International Journal of Rock Mechanics and Mining Sciences; Elsevier. 2. Kenew AE. Geology for Engineering Scientists, Pearson; 2014. 3. Verruijt A. Soil Mechanics, Delft University of Technology; 2012.				
Form of teaching	Lecture (2 UoI) Recitation/Lab (2 UoI)				
Assessment method	Written examination (90 min.) and academic performance.				
Associated study program	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering				
Prerequisites for participation	Completion of semester 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%.				

RMPE304 – THERMODYNAMICS FOR CHEMICAL ENGINEERING

Module title	Thermodynamics for Chemical Engineering			**Module code**	RMPE304
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. M. Bayanmunkh			**Language**	English
Contents	Phase equilibrium, Pure species, Mixtures, Physical properties of gases and liquids, Chemical potential and fugacity, Gibbs' fundamental equation, Equilibrium conditions, Gibbs-Duhem equation, Excess Gibbs free energy, ge-models, Vapor-liquid equilibria, Azeotrope, 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. Recognize intensive thermodynamic variables from extensive thermodynamic variables, derive the Gibbs-Duhem equation, and apply it to various heterogeneous equilibria. 3. Identify 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	1. Koretsky MD. Engineering and Chemical Thermodynamics, 2nd ed., Wiley; 2012.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Oral exam (30 min.) and academic performance				
Associated study program	B.Sc. Raw Materials and Process Engineering				
Prerequisites for participation	Completion of semester 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%.				

ENVE304 – INTRODUCTION TO MICROBIAL BIOTECHNOLOGY

Module title	Introduction to Microbial Biotechnology			**Module code**	ENVE304
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Dr. T. Narangarav			**Language**	English
Contents	Cell and macromolecules. Types of microorganisms and their specific relevance for the environment and human health (protozoa, bacteria, viruses, helminths, fungi). Biotechnical applications of microorganisms – specific examples (e.g. wastewater treatment, food industry, bioleaching, biocontrol agents in agriculture, remediation of contaminated soils). Modifications of microorganisms by genetic engineering – potentials and risks. Drug – resistant microorganisms in the environment – current threats and control strategies. Biosafety and bioethics: the limits of using microorganisms in the natural and engineered environment. Detection of microorganisms in the laboratory scale on the environmental samples.				
Learning outcomes	This module aims at providing future engineers a general overview about the relevance of microbiology and potentials and limitations of microbial biotechnology. On successful completion of this module, students should be able to: 1. Describe the basic concepts of microbiology such as cells and macromolecules. 2. Differentiate between different microorganisms and identify their roles in the natural environment. 3. Describe the relevance of microorganisms for biotechnological applications. 4. Describe and critically reflect the potentials and risks genetic engineering of microorganisms. 5. Explain the growing threats by drug-resistant microorganisms in the environment and understand control strategies. 6. Evaluate safety and ethical issues related to the application of microbial biotechnology. 7. Grow bacteria in the laboratory and analyze the experimental data.				
Literature	2. Hu WS. Engineering Principles in Biotechnology. Hoboken, NJ, USA: Wiley & Sons Inc; 2018. 3. Ivanov V. Environmental Microbiology for Engineers. Boca Raton, Florida, USA: CRC Press; 2015. 4. Sherwood L, Willey JM, Woolverton C. Prescott's microbiology. McGraw-Hill; 2011.				
Form of teaching	Lecture (2 UoI) Laboratory (1 UoI) Field trip (1 UoI)				
Assessment method	Oral examination (90 min.) and academic performance.				
Associated study program	B.Sc. Environmental Engineering 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 50% and the module examination accounting for 50%.				

RMPE305 – MINERAL PROCESS ENGINEERING II

Module title	Mineral Process Engineering II			**Module-Code**	RMPE305
Duration	1 semester	**Semester**	Spring semester	**Module-Start**	6th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	60 h
				Individual study	120 h
Module coordinator	Prof. M. Bayanmunkh			**Language**	English
Contents	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	1. AT Mineral Processing Journal. 2. Wills BA. “Mineral Processing Technology”, 4th edition, Pergamon Press, Oxford; 1988. 3. Weiss NL. SME Mineral Processing Handbook, New York: Society of Mining Engineers; 1985.				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI) Field trip (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				
Prerequisites for participation	Completion of Mineral Process Engineering I				
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%				

RMPE306 – THERMAL UNIT OPERATIONS

Module title	Thermal Unit Operations			**Module code**	RMPE306
Duration	1 semester	**Semester**	Spring	**Module start**	7th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	60 h
				Individual study	120 h
Module coordinator	Prof. M. Bayanmunkh			**Language**	English
Contents	Equilibrium stage, non-equilibrium stage, pure species, mixtures, 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	1. McCabe WL, Smith JC, Harriott P. Unit Operations of Chemical Engineering, 7th ed., McGraw-Hill; 2004.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI) Laboratory (1 UoI)				
Assessment method	Oral examination (30 min.) and academic performance				
Associated study program	B.Sc. Raw Materials and Process Engineering				
Prerequisites for participation	Completion of semester 1-4 and *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%				

EEEJ306 – RENEWABLE ENERGY

Module title	Renewable Energy			**Module code**	EEEJ306
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. P. Ariunbolor			**Language**	English
Contents	This module introduces students to renewable energy sources, energy generation techniques, and the efficiency of energy usage: • Renewable energy sources (overview of hydropower, wind power, solar energy, geothermal systems and biomass): ecological advantages, challenges for implementation (cost, suitable locations, acceptance, and negative environmental impacts). • Solar Energy: Power Generation with Solar Energy; Solar insolation: Energy sources for photovoltaics, Photovoltaic technologies (Si-wafer based vs. Thin-Film PV), Solar cell materials • Wind power: wind characteristics (velocity distribution, density), power calculation and power curve of a wind turbine, structure of wind turbines (vertical, horizontal) • Hydroelectric power: Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants • RETSCreen Software: https://www.nrcan.gc.ca/maps-tools-and publications/tools/modeling-tools/retscreen/7465 Students will have the opportunity to learn the software RETScreen to design PV, Wind and Bioenergy systems. • 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).				
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. Design of wind- and solar-parks 3. Assess the efficiency of energy production and consumption for typical examples from Mongolia (e.g. thermal power plants, insulation of buildings, transport sector) 4. Apply knowledge about the preconditions for an effective usage of energy system				
Literature	1. Peddapelli SK, Virtic P. Wind and Solar Energy Applications. CRC Press, Taylor & Francis Group; 2023. 2. Motahhir S, editor. Digital Technologies for Solar Photovoltaic Systems: From General to Rural and Remote Installations. The Institution of Engineering and Technology; 2023. 3. Buchla DM, Kissel TE, Floyd TL. Renewable Energy Systems. Pearson; 2015.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (90 min.) and academic performance.				

Associated study program	B.Sc. Mechanical Engineer B.Sc. Environmental Engineering B.Sc. Energy and Electrical Engineering B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Completion of Introduction to Electrical Engineering is required.
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%.

RMPE307 – MINING AND ENVIRONMENT

Module title	Mining and Environment			**Module code**	RMPE307
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. T. Hollenberg			**Language**	English
Contents	The module deepens the view of engineers on 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/emissions				
Learning outcomes	Upon successful completion of this module, the students will, through assessment activities, show evidence of their ability to: 1. Describe and interpret the market pressures under which raw materials companies must operate today. 2. Summarize and evaluate the current requirements for environmental protection as applied to raw material extraction. 3. Reflect on the awareness of the whole question of environmental protection. 4. Recognize and evaluate specific problems by given case studies				
Literature	1. Hustrulid WA. Open Pit Mine Planning and Design, CRC Press; 2013. 2. Azcue JM. Environmental Impacts of Mining Activities. Emphasis on Mitigation and Remedial Measures, Springer; 2011. 3. Lottermoser B. Mine Wastes, Springer, Heidelberg; 2010. 4. Stoll RD, Niemann-Delius C, Drebenstedt C, Müllensiefen K. Der Braunkohlentagebau, Springer; 2009. 5. Spitz K. Mining and the Environment. From Ore to Metal, CRC Press; 2008.				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Field Trip (1 UoI)				
Assessment method	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%.				

INTR301 – INDUSTRIAL INTERNSHIP + REFLECTION

Module title	Industrial Internship + Reflection			**Module code**	INTR301
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	10 CP	**Workload**	14 weeks internship	**Contact hours**	
				Individual study	300 h
Module coordinator	Prof. M. Bayanmunkh			**Language**	English
Contents	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	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 method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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				

RMPE401 – CHEMICAL REACTION ENGINEERING

Module title	Chemical Reaction Engineering			**Module code**	RMPE401
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Prof. M. Hampe			**Language**	English
Contents	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	1. Jess A, Wasserscheid P. Chemical Technology: An Integral Textbook, Wiley; 2013. 2. Fogler S. Elements of Chemical Reaction Engineering, 4th ed., Pearson Prentice Hall; 2005. 3. Schmidt LD. The Engineering of Chemical Reactions, Oxford University Press; 1998.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	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%				

RMPE402 – HYDROMETALLURGY

Module title	Hydrometallurgy			**Module code**	RMPE402
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	60 h
				Individual study	120 h
Module coordinator	Prof. M. Bayanmunkh			**Language**	English
Contents	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	1. Pandey ABD, Natarajan KA. Microbiology for Minerals, Metals, Materials, and the Environment. CRC Press; 2015. 2. Donati ER, Sand W. Microbial Processing of Metal Sulfides. Springer; 2007. 3. Rawlings DE, Johnson DB. Biomining, Springer; 2007. 4. Weert G. Hydrometallurgy, Part A and B; 1997. 5. Weiss NL, SME Mineral Processing Handbook, Volume 2, Hydrometallurgy Section 13; 1985. 6. Pawlek F. Metallhuettenkunde; 1983.				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI) Field trip (1 UoI)				

Assessment method	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%

RMPE403 – FOSSIL FUEL TECHNOLOGY

Module title	Fossil Fuel Technology			**Module code**	RMPE403
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Module coordinator	Dr. N. Undrakh			**Language**	English
Contents	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 characterization of solid, liquid, and gaseous fuels, and 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 carbonization and coking of biomass, lignite and coal, gassing of solid fuels in solid beds, fluidized 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	1. Jess A, Wasserscheid P. Chemical Technology: An Integral Textbook, Wiley; 2013. 2. Higman C, Burgt M. Gasification, Elsevier Science; 2003.				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Oral examination (30 min.) and academic performance				
Associated study program	B.Sc. Raw Materials and Process Engineering				
Prerequisites for participation	Completion of semester 1-4 and *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%				

MECH404 – OPEN PIT EXCAVATION + UNDERGROUND MINING MACHINES

Module title	Open Pit Excavation + Underground Mining Machines			**Module code**	MECH404
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Module coordinator	Prof. T. Hollenberg			**Language**	English
Contents	**Open-cast extraction**: continuous excavators, construction, stability and safety in use of: chain-and-bucket excavators and bucket-wheel excavators, surface miners, extraction tools, cutting forces, power calculations, power drives, overload protection, slewing units, undercarriages, cornering, track moving machinery, conveyor bridges, spreaders, bench conveyors; discontinuous excavators, cable and dragline excavators, hydraulic excavators, wheel loaders, combinations with rail-less technology (heavy-duty trucks), bulldozers, lignite-bunker technology; open-cast mining safety with retaining walls. **Underground mining** of salt, coal, ore deposits, room-and-pillar mining and longwall mining, options for mine safety, structure of a production shaft; shaft hoisting equipment:, hoisting procedures, hoisting cables, charging cables, hoisting frames and skips, special breaking systems, technical requirements in accordance with ISO ICS 73 (Mining and Quarrying); drilling and blasting – bolthole and blasthole drilling machines, mechanical extraction - continuous miner, boom type roadheaders, slit cutters, ripper; rail-less transport: loaders etc., types of belt conveyors; longwall mining (coal): armoured face conveyors (AFC), structural design and sizing, combination AFC with self-advancing shield supports, types of ploughs, plough control, drive technology for plough and AFC, dynamic force effects, load equalization, chain pre-tensioning, shearer loader, cutting and loading behavior, sprinklers, underground development with shearer loaders and roadheaders, monorails, train operation; pneumatic backfill machines; gob backfilling.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe, compare and assess machinery for above-ground extraction and conveyor systems for mineral raw materials (open-cast mining, quarries, gravel pits). 2. Predict the suitability of the machinery for the structure of the raw material under given circumstances. 3. Differentiate between the individual sub-assemblies, drives and machine elements, and describe the way in which they operate together. 4. Categorize underground equipment and explain its operation. 5. Design and size machines and equipment for extraction and transport of raw materials below ground. 6. Select the appropriate equipment for a given task. Assess the performance and identify possible problems of particular combinations of equipment.				
Literature	1. Darling P. SME Mining Engineering Handbook, Society for Mining, Metallurgy, and Exploration; 2011. 2. Kennedy BA. Surface mining, Littletown, Colo: Society for Mining, Metallurgy and Exploration; 1990.				
Form of teaching	Lecture (3 UoIL) Recitation (1.5 UoIR)				
Assessment method	Written examination (90 min.) and academic performance				

Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Engineering Mechanics I-IV; Fluid Mechanics
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%

STWR401 – SCIENTIFIC WRITING

Module title	Scientific Writing			**Module code**	STWR401
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	24 h
				Individual study	96 h
Module coordinator	Prof. G. Gantuya			**Language**	English
Contents	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 research. 4. Grasp didactically prepared mediation. 5. Give and assess verbal presentations. 6. Apply moderation techniques.				
Literature	None				
Form of teaching	Recitation (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	None				
Requirements for receiving credit points	Passing the module				
Grading system	Pass / Fail				

RMPE404 – PROCESS SYSTEM ENGINEERING

Module title	Process System Engineering			**Module code**	RMPE404
Duration	1 semester	**Semester**	Spring	**Module start**	8th
Credit points	8 CP	**Workload**	240 h	**Contact hours**	72 h
				Individual study	168 h
Module coordinator	Prof. Hampe			**Language**	English
Contents	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 the cost and profitability of investments in the field of process engineering.				
Literature	1. Adams TA. Learn Aspen Plus in 24 hours, McGraw Hill; 2018. 2. Turton R, Baile RC, Whiting WB, Shaewitz JA, Bhattacharyya D. Analysis, synthesis, and design of chemical processes, Prentice Hall; 2009.				
Form of teaching	Lecture (3 UoI) Recitation (2 UoI) Laboratory (1 UoI)				
Assessment method	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%

PROJ401 – FINAL STUDY PROJECT

Module title	Final Study Project			**Module code**	PROJ401
Duration	1 semester	**Semester**	Spring	**Module start**	8th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Module coordinator	Prof. M. Hampe			**Language**	English
Contents	Students from different engineering disciplines will work as a team on a current research topic. Through the module students will learn and practice: Soft skills to cooperate. Brainstorming to find a solution. Formulate engineering problems. Problem solving procedures. Application of engineering knowledge for solution. Computation of initial and life cycle cost of system.				
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 (3-weeks interdisciplinary project work, and 1-day field trip), supervised by lecturers of all disciplines involved.				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%)				

THES401 – BACHELOR THESIS + COLLOQUIUM

Module title	Bachelor Thesis + Colloquium			**Module code**	THES401
Duration	1 semester	**Semester**	Spring	**Module start**	8th
Credit points	12 CP	**Workload**	360 h	**Contact hours**	
				Individual study	360 h
Module coordinator	Supervisors			**Language**	English
Contents	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 method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	Possible prerequisites will be prescribed by the individual institute supervising the thesis. At least 171 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”.				

ENGINEERING ELECTIVE MODULES

ENSS150 – ENGINEERING SUMMER SCHOOL

Module title	Engineering Summer School			**Module code**	ENSS150
Duration	2 weeks	**Semester**	Fall or Spring	**Module start**	2nd
Credit points	3 CP	**Workload**	90 h	**Contact hours**	60 h
				Individual study	30 h
Module coordinator	Dr. T. Narangarav			**Language**	English
Contents	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	None				
Form of teaching	Lab work, excursion, field trip, lectures				
Assessment method	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 B.Sc. Energy and Electrical Engineering				

	B.Sc. Mechatronic 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 weeks	**Semester**	Fall or Spring	**Module start**	4th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	60 h
				Individual study	30 h
Module coordinator	German Professors (TDB)			**Language**	English
Contents	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	None				
Form of teaching	Lab work, excursion, field trip, lectures				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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

ENVE307 – SOIL SCIENCE

Module title	Soil Science			**Module code**	ENVE307
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	6 CP	**Workload**	180	**Contact hours**	48 h
				Individual study	132 h
Module coordinator	S. Enkhjargal			**Language**	English
Contents	The module is designed to provide an overview of the fundamental concepts in of soil. Topics of the module: Soil formation: • anorganic source materials and forms of weathering • organic source materials and forms of decomposition • determinants of soil formation (climate, water, vegetation, fauna, topography / relief, time, human influence) • soil formation pathways on different substrates Properties of soils: • soil textures: sand, silt, clay, loam and other mixed textures • soil colors and their relevance • soil hydrology and aeration • soil chemistry, especially ion exchange processes and their drivers, soil pH and redox potential • biotic components of soils: roles of bacteria, fungi (e.g. mycorrhizae), invertebrates Soil types: • horizons and their relevance • translocation processes between horizons • soil classification systems and soil maps • major soil types of Mongolia Besides the theoretical backgrounds, this module introduces students to practical examinations of soils in the field and laboratory (texture, horizons, physico-chemical properties).				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe the main properties of soils and their formation. 2. Compare different soil types and textures according to their advantages and disadvantages for certain uses (e.g. agriculture). 3. Identify and characterize soil types and textures in the field using only simple aids (e.g. Munsell colour chart, finger tests). 4. Apply simple laboratory methods to quantify the moisture and organic carbon Contents of soils, soil texture, soil pH. 5. Combine different information sources to roughly assess soil fertility (cation exchange capacity). 6. Define influences on soil quality and manage the soil physical properties. 7. Describe the fundamentals of soil and land use management.				
Literature	1. Plaster E. Soil Science and Management. London: Delmar Cengage Learning; 2013.				
Form of teaching	Lecture (1 UoI)				

	Recitation (2 UoI) Laboratory/Field trip (1 UoI)
Assessment method	Oral (30 min.) or written examination (60 min.) and academic performance (including field report)
Associated study program	B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering
Prerequisites for participation	Introduction to Geosciences
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% .

MECH303 – ENGINEERING MECHANICS IV

Module title	Engineering Mechanics IV (Machine Elements)			**Module code**	MECH303
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Module coordinator	Prof. N. Odbileg			**Language**	English
Contents	**Machine Design** is for engineers a key qualification and responsibility as it integrates and combines basic **Engineering Mechanics** (where forces are acting, how large these forces are), **Materials Science** (which materials are suitable to withstand these forces) and also **Engineering Design** (i.e. the documentation and communication of a design by technical drawings / CAD) into the ability to calculate the dimensions of machine elements, i.e. standard elements or specifically designed components or combinations. The course includes the properties, construction, dimensioning including calculations of (basic) machine elements, especially shafts, joints (form-locked: rivets, pins, bolts etc., force-locked: screws, nuts & bolts etc., material-bonded: welding, brazing, gluing etc.), shaft-hub-joints, springs, bearings (friction bearings, ball bearings etc.), couplings, seals, and gearing mechanisms				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Determine a group of mechanical components (simple machines) is supposed to achieve by looking at the CAD/technical drawing. 2. Decide which standard elements are suitable to perform a set of given tasks and document that decision. Calculate the dimensions of simple mechanical components and combinations to perform a given task (and document the course of these calculations).				
Literature	1. Norton RL. Machine Design: An Integrated Approach, 5th edition, Pearson; 2016. 2. Shigley JL. Mechanical Engineering Design, 10th edition, McGraw-Hill Education; 2016.				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (0.5 UoI) Field Trip (1 UoI)				
Assessment method	Written examination (120 min.) and academic performance.				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Mechatronic Engineering B.Sc. Raw Materials and Process Engineering				
Prerequisites for participation	Engineering Mechanics I and II				
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%.

MECH406 – CLASSIFIERS AND MIXERS + COARSE COMMINUTION MACHINES

Module title	Classifiers and Mixers + Coarse Comminution Machines			**Module code**	MECH406
Duration	1 semester	**Semester**	Spring	**Module start**	8th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	60 h
				Individual study	120 h
Module coordinator	Dr. Yanjkhlam (Part-time lecturer)			**Language**	English
Contents	Construction and design of mixers (e.g. mechanical mixers, pneumatic mixers, fluid mixers, mixing beds) and classifier machines (e.g. static screens, vibrating screens, flip-flow screens, drum screens, static and dynamic classifiers). Construction and design of crushers (e.g. of jaw, barrel, roller, impact and hammer crushers).				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Design the mixer and classifier machines that they have studied, perform the calculations, and construct and assemble their main components. 2. Predict the durability of the machines in relation to the stresses to which they will be subjected. 3. Draw up plans for preventive maintenance. 4. Design, calculate and construct machines and systems for coarse crushing. 5. Apply these machines correctly and predict their fitness for purpose in relation to the loads to which they are subjected.				
Literature	1. Young C. Separation Technologies. 2012. 2. Joukari A. Raw Material Preparation. 2002. 3. Parisau WG. Design Analysis in Rock Mechanics. 2002. 4. Torjan C. Mineral Processing. 1986. 5. Weiss NL. SME Mineral Processing Handbook, New York: Society of Mining Engineers; 1985.				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI) Field Trip (1 UoI)				
Assessment method	Written examinations (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-IV; Virtual Product Design; Mechanical Process Engineering I				
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%)

ENVE402 – WATER SUPPLY

<table>
<tr><td>Module title</td><td colspan="3">Water Supply</td><td>Module code</td><td>ENVE402</td></tr>
<tr><td>Duration</td><td>1 semester</td><td>Semester</td><td>Fall</td><td>Module start</td><td>7th</td></tr>
<tr><td>Credit points</td><td>8 CP</td><td>Workload</td><td>240 h</td><td>Contact hours</td><td>72 h</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Individual study</td><td>168 h</td></tr>
<tr><td>Module coordinator</td><td colspan="3">Dr. Ts. Ariuntuya</td><td>Language</td><td>English</td></tr>
<tr><td>Contents</td><td colspan="5">Basic principles:
• Legal and administrative principles of water supply, water extraction and delivery (country-specific, international).
• Quality of ground water and surface water.
• Water protection zones.
• Water balance equation, water consumption and water resources.
• Water catchment systems, plants for groundwater enrichment, dimensioning of water pipework, and water pumping equipment.
• Water storage:
• Construction, arrangement and designing of water reservoirs.
Water distribution:
• Forms and designs of water supply networks.
• Water treatment:
• Introduction.
• Fields of application of the various water treatment processes subdivided according to raw water types.
• Flocculation and precipitation.
• Rapid filtration, sedimentation, flotation, filtration, and membrane processes.
• Carbon dioxide in drinking water: principles of the lime / carbon dioxide balance - De-acidification/softening/desalination.
• Removal of iron and manganese.
• Disinfection.
Water quality management for drinking water reservoirs:
• Limnological principles of standing water.
• Catchment area management.
• Management of reservoirs.
• Treatment of raw water from reservoirs.
• Water body restoration.
• Reservoir operation and maintenance.
• Maintenance strategies in water supply and their implementation (especially reduction of water losses, electronic data-processing applications in water supply etc.), carrying out design tasks.
• Application and consolidation of the lecture Contents by working unassisted in groups on specific design tasks.
This course includes the following practical/laboratory work:
• Sampling strategies for raw and drinking water.
• Microbiological quality of raw and drinking water.</td></tr>
</table>

	• Physico-chemical quality of raw and drinking water (e.g. pH, EC, BOD/COD, nutrients, Cl, main elements).
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe the legal requirements for raw water quality and drinking water quality in water supply. 2. Explain technical processes used for water supply, including their interlinkages with water purification. 3. Calculate and evaluate unassisted the sizing and design of plants for water extraction and distribution. 4. Recall the country-specific and international legal requirements for raw water quality and drinking water quality as they relate to drinking water supply. 5. Explain the technical processes in water treatment, and their interlinkages 6. Calculate and evaluate unassisted the sizing and design of plants for water treatment. 7. Analyze the operation and maintenance of plants for water supply (maintenance strategies, reduction of water losses, etc.). 8. Develop a sampling strategy and apply analytical methods for detecting pollutants in raw and drinking water.
Literature	1. Viessman WJ, Hammer MJ. Water Supply and Pollution Control. Eighth Edition; 2014. 2. Ratnayaka DD. Twort's Water Supply. Butterworth-Heinemann; 2009.
Form of teaching	Lecture (2 UoI) Recitation (2 UoI) Field trip/Laboratory (2 UoI)
Assessment method	Written examination (120 min.) and academic performance (including lab report)
Associated study program	B.Sc. Environmental Engineering
Prerequisites for participation	Principles of Water Technology recommended.
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module, accounting for 40%, and the module examination accounting for 60%.

RMPE405 – PYROMETALLURGY

Module Title	Pyrometallurgy			**Module code**	RMPE405
Duration	1 Semester	**Semester**	Fall	**Module start**	7th
Credit Points	6 CP	**Workload**	180 h	**Contact hours**	60
				Individual study	120
Module Coordinator	Prof. M.Bayanmunkh			**Language**	English
Content	Theoretical principles: • Pyrometallurgical and high temperature processes • Thermodynamics and kinetics aspects of pyrometallurgy • Agglomeration, roasting, smelting thermal and electrolytic refining • Structure and properties of metallurgical slags • Electrochemical processes/equilibria • Reduction and oxidation of metals and impurities etc. Various pyrometallurgical processes, which are used for extraction and refining of non-ferrous metals and recyclable materials with: • Calcination • Roasting • Smelting/Converting • Carbothermic reduction • Electrorefining. Process examples from non-ferrous metallurgy/Cu smelting, Zinc roasting, iron and steelmaking, lead smelting and refining					
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 pyrometallurgy 2. Interpret of kinetics and thermodynamics by pyrometallurgical process 3. Utilize of plant principles, design and scale up 4. Undertake key engineering calculations relating to the characterisation of metallurgical systems 5. Verify the technologies used in Pyrometallurgy				
Literature	1. Schlesinger ME, King MJ, Sole KC, Davenport WG. Extractive Metallurgy of Copper; 2011. 2. Habashi F. Principles of Extractive metallurgy. Vol. 3, Chiranjib Kumar Cupta. Chemical Metallurgy; 2003				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI) Excursion (1 UoI)				
Assessment methods	Successful participation, group presentation, report				

Associated study programme	B.Sc. Raw Materials and Process Engineering
Prerequisites for participation	Fluid mechanics, Heat and Mass transfer, Thermodynamics for Chemical Engineering
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounted for 30% and the module examination accounted for 70%

LANGUAGE ELECTIVE MODULES

ENGL010 – ENGLISH

Module title	English C1			**Module code**	ENGL010
Duration	1 semester	**Semester**	Fall	**Module start**	BEP, 1st
Credit points		**Workload**		**Contact hours**	96 h
				Individual study	
Module coordinator	Prof. Ch. Gunpilmaa, D. Suvdanchuluun			**Language**	English
Contents	**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. Write correctly to a large degree on a number of complex topics. 3. Follow and grasp different kinds of spoken language, live or broadcast 4. Read with ease complex texts and summarize correctly and concisely written texts and oral presentations in their own words. 5. Deliver a presentation using a clear organized structure, helpful slides, and signposting 6. Integrate their reading, writing, and speaking skills to promote creative thinking and independent learning				
Literature	1. Dooley VEJ, Edwards L. Upstream Advanced C1, Express Publishing; 2005. 2. Evans V, Edwards L, Dooley J. 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 method	(70%) = Final examination (written and oral) (30%) = Short presentations, in-class assignments, quizzes,mid-term exam				
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	• 80% attendance • Academic performance • Final examination : written and oral examination • Students who failed the exam in the first semester may retake the module in the second semester				

Grading system	The modes of assessment total 100%.

ENGL150 – ACADEMIC WRITING I

Module title	Academic Writing I			**Module code**	ENGL150
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	1st, 2nd, 3rd, 4th, 5th, 6th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	D. Suvdanchuluun			**Language**	English
Contents	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: 3. Recognize, understand and recall the structural components of academic writing at paragraph and essay levels. 4. Identify and apply formal register and tone. 5. Analyze and evaluate different types of academic writing, e.g. essays, reviews and reports. 6. Summarize the main points of academic texts in writing. 7. Organize and present arguments in a logical fashion. 8. Apply cohesive devices. 9. Create their own pieces of academic writing. 10. Critically examine and improve upon their own writing. 11. Apply the skills acquired in the module to their further academic studies .				
Literature	1. Savage A, Mayer P. Effective Academic Writing 2; 2006. 2. Jordan RR. Academic Writing Course, Longman; 2003.				

	3. Barnet S, Stubbs M. Practical Guide to Writing, Harper Collins. Websites: IELTS Writing Skills, British Council, BBC Learn English Writing skills; 1985.
Form of teaching	Recitation (4 UoI)
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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

MNGL150 – MONGOLIAN STYLISTICS

Module title	Mongolian Stylistics			**Module code**	MNGL150
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	1st, 2nd, 3rd, 4th,
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Module coordinator	D. Suvdanchuluun			**Language**	English
Contents	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	1. Мөнхцэцэг С. Орчин цагийн монгол хэлний найруулга зүйн дасгал, Улаанбаатар; 2016. 2. Оюунбат Ц, Мөнхцэцэг С. Монгол хэлний найруулга зүй, Улаанбаатар; 2012. 3. Мон судар. Монгол хэлний хураангуй тайлбар толь, Мон судар; 2009. 4. Сүхбаатар Ц. Монгол хэлний найруулга зүй, Улаанбаатар; 2007.				
Form of teaching	Recitation (2 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	C1 level of English and successful completion of Academic Writing				
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 – EUROPEAN HISTORY

Module title	European History			**Module code**	HIST150
Duration	1 semester	**Semester**	Fall	**Module start**	5th, 7th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	Robin Charpentier			**Language**	English

Contents

European Pre-History: Themes, Questions in the Study of History

- Time and Space Considerations; How and Why we Study History
- Stone Age: Paleolithic and Neolithic

Early European Civilization:

- Early Bronze Age – The Minoans
- Archaic Greece
- Classical Greek Period
- Hellenistic Culture
- Central European Late Iron Age Cultures (Hallstatt, La Tène)
- City of Rome to Roman Kingdom/Punic Wars
- Formation and Expansion of Roman Empire
- The Fall of the Roman Empire

Mid-Term Exam

Late Antiquity/Early Middle Ages

- Nomadic Conquests of Western Roman Empire
- Eastern Roman Empire and Byzantium
- Holy Roman Empire
- Age of Vikings
- Muslim Conquests
- Holy Wars: The Crusades
- The Mongol Conquests in its Western Empire and in Eastern Europe; Pax Mongolica

Learning outcomes

On successful completion of this module, the students should be able to:

1. Identify factors associated with the major cultural changes that have contributed to and shaped Europeans' distinctive worldview
2. Compare and contrast these factors with relevant time periods in Mongolian history
3. Think critically about: the role and presence/absence of original sources; and about the role of spatiality and time in the creation of an historical record.

Literature

1. Duiker WJ, Spielvogel JJ. World History 8th edition; 2016.
2. Spielvogel JV. Glencoe World History, Glencoe-McGraw Hill. Various primary source materials in photocopy; 2008.

Form of teaching

Recitation (4 UoI)

Assessment method	(70%) = Written final examination (30%) = Active in-class participation (15%); tests, mid-term exam, final oral presentation (15%)
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering
Prerequisites for participation	English at the C1 level in all 4 skills
Requirements for receiving credit points	1. Attendance is recorded for those arriving before the scheduled start time 2. Participation means: volunteering answers; asking and/or responding to questions; paying attention; actively focusing on in-class tasks; turning in assignments on time and with good quality
Grading system	The modes of assessment total 100%

GERL151 – GERMAN A1.1

Module title	Deutsch A1.1/ German A1.1			**Module code**	GERL151
Duration	1 semester	**Semester**	Fall	**Module start**	1st, 3rd, 5th, 7th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	B. Batsuren, B. Bolormaa			**Language**	German
Contents	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	1. Paar-Grünbichler F, Finster WKJ. Panorama. Deutsch als Fremdsprache. Kursbuch A1 und Übungsbuch A1, Cornelsen Verlag; 2018. 2. Funk K. Studio 21. Das Deutschbuch. A1.1, Cornelsen Verlag; 2013.				
Form of teaching	Recitation (4 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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%).

GERL152 – GERMAN A1.2

Module title	Deutsch A1.2/ German A1.2			**Module code**	GERL152
Duration	1 semester	**Semester**	Spring	**Module start**	2nd, 4th, 6th, 8th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	B. Batsuren, B. Bolormaa			**Language**	German
Contents	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	1. Paar-Grünbichler F, Finster WKJ. Panorama. Deutsch als Fremdsprache. Kursbuch A1 und Übungsbuch A1, Cornelsen Verlag; 2018. 2. Funk K. Studio 21. Das Deutschbuch. A1.1, Cornelsen Verlag; 2013.				
Form of teaching	Recitation (4 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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	**Module start**	1st, 3rd, 5th, 7th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	B. Batsuren, B. Bolormaa			**Language**	German
Contents	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	1. Paar-Grünbichler F, Finster WKJ. Panorama. Deutsch als Fremdsprache. Kursbuch A1 und Übungsbuch A1, Cornelsen Verlag; 2018. 2. Funk K. Studio 21. Das Deutschbuch. A1.1, Cornelsen Verlag; 2015.				
Form of teaching	Recitation (4 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 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	**Module start**	2nd, 4th, 6th, 8th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	B. Batsuren, B. Bolormaa			**Language**	German
Contents	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	1. Paar-Grünbichler F, Finster WKJ. Panorama. Deutsch als Fremdsprache. Kursbuch A2 und Übungsbuch A2, Cornelsen Verlag; 2018. 2. Funk K. Studio 21. Das Deutschbuch. A2.2, Cornelsen; 2015.				
Form of teaching	Recitation (4 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 and the module examination accounting for 70%.

GERL351 – GERMAN B1.1

Module title	Deutsch B1.1/ German B1.1			**Module code**	GERL351
Duration	1 semester	**Semester**	Fall	**Module start**	1st, 3rd, 5th, 7th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	B. Batsuren, B. Bolormaa			**Language**	German
Contents	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	1. Paar-Grünbichler F, Finster WKJ. Panorama. Deutsch als Fremdsprache. Kursbuch B1 und Übungsbuch B1, Cornelsen Verlag; 2018. 2. Funk K, Kiontke W. Studio 21. Das Deutschbuch. B1.1, Cornelsen Verlag; 2015.				
Form of teaching	Recitation (4 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 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	**Module start**	2nd, 4th, 6th, 8th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	B. Batsuren, B. Bolormaa			**Language**	German
Contents	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	1. Paar-Grünbichler F, Finster WKJ. Panorama. Deutsch als Fremdsprache. Kursbuch B. und Übungsbuch B1, Cornelsen Verlag; 2018. 2. Funk K, Kiontke W. Studio 21. Das Deutschbuch. B1.2, Cornelsen Verlag (tests and homework assignments; 2015.				
Form of teaching	Recitation (4 UoI)				
Assessment method	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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic 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 and the module examination accounting for 70%.

GERL451 – GERMAN B2.1

Module Title	Deutsch B2.1/German B2.1			**Module code**	GERL451
Duration	1 semester	**Semester**	Fall	**Module start**	1st, 3rd, 5th, 7th
Credit Points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	B. Batsuren, B. Bolormaa			**Language**	German
Contents	Development and application of the knowledge and skills acquired at A1, A2 and B1 levels. Additional topics include: Language learning methods live and work in big cities, digital worlds and climate change. Grammar points include: conjunctions and subordinated sentences, passive forms with modal verbs, relative clauses, word formation and conditional are introduced or revised.				
Learning Outcomes	Upon successful completion of this module, students are able to: 1. understand the main and detail ideas of complex texts on concrete and abstract topics; 2. communicate so spontaneously and fluently that a normal conversation with native speakers is easily possible without much effort on either side. 3. produce clear, detailed text on a wide range of subjects, explaining a point of view on a topical issue giving the advantages and disadvantages of various options. 4. reflect the structure of emails and write emails with link forms 5. compare and comment on information 6. interpret graphics 7. Arranging sections of text logically and arguing 8. write a structured statement 9. respond to speeches and conduct discussions 10. summarize articles in writing and orally 11. write formal emails				
Literature	1. Braun B, Mautsch FJ, Schmeiser SS. Kompass DaF B2.1 Deutsch für Studium und Beruf. Das Kurs-und Übungsbuch. B2.1, Ernst Klett Sprachen Verlag; 2020.				
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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	Successful completion of the module German B1.2 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 accounted for 30% and the module examination accounted for 70%

GERL452 – GERMAN B2.2

Module Title	Deutsch B2.2/German B2.2			**Module code**	GERL452
Duration	1 semester	**Semester**	Spring semester	**Module start**	2nd, 4th, 6th, 8th
Credit Points	3 CP	**Workload**	90 h	**Contact hours**	48 h
				Individual study	42 h
Module coordinator	B. Batsuren, B. Bolormaa			**Language**	German
Contents	Development and application of the knowledge and skills acquired at A1, A2 and B1 levels. Additional topics include: education/dual system, healthy foods/eating, sports/health insurance, motivation and praise and intercultural Competence. Grammar points include: conjunctions and subordinated sentences, indirect speech Subjunctive I, modal sentences, Partizip I and II-forms as an adjective, unreal conditions, unreal comparison sentences, word formation and phrasal verbs are introduced or revised. Completion of level B2 (Upper-Intermediate).				
Learning Outcomes	Upon successful completion of this module, students are able to: 1. reflect/recognize the structure of emails and use emails with link forms 2. compare and comment on information 3. interpret graphics 4. arrange texts logically and argue 5. write a structured statement 6. respond to speeches and conduct discussions 7. summarize articles in writing and orally 8. write formal emails				
Literature	1. Braun B, Mautsch FJ, Schmeiser SS. Kompass DaF B2.1 Deutsch für Studium und Beruf. Das Kurs-und Übungsbuch. B2.1, Ernst Klett Sprachen Verlag; 2020.				
Form of teaching	Recitation (4 UoI)				
Assessment methods	Written examination (120 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 B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	Successful completion of the module German B2.1 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 accounted for 30% and the module examination accounted for 70%