GERMAN - MONGOLIAN INSTITUTE FOR RESOURCES AND TECHNOLOGY

BACHELOR OF SCIENCE IN ENERGY AND ELECTRICAL ENGINEERING

MODULE HANDBOOK (1st – 8th semester)

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INTRODUCTION

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

To be admitted to the specialized B. Sc. "Energy and Electrical Engineering" program, students need to have successfully completed the "joint foundation studies" course at GMIT, comprising the first four semesters.

The application oriented first cycle degree course "Energy and Electrical Engineering "aims at providing knowledge, abilities and competencies in engineering, mathematics and natural sciences in order to enable the graduate to design, develop, and operate products of Electrical Engineering and Energy System in economic, ecologic and sustainable ways.

Its objective is to qualify the graduate of the first cycle degree course "Energy and Electrical Engineering" for an application-oriented employment or entrepreneurship in the field of Electrical Engineering and Energy System, and for live long learning.

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

The graduates of the first cycle degree course "Energy and Electrical Engineering "will be able to

- Apply mathematical, scientific and engineering principles for solving problems of mechanical engineering.
- Recognize and analyze 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 mechanical engineering.
- Apply information science for solving mechanical engineering problems.
- Work in international teams in order to solve extensive and interdisciplinary problems.
- Recognize the consequences of engineering activities in order to act responsibly within and for the society, the economy, and the environment.

STUDY PLAN

CPs	1st Semester	2nd Semester	3rd Semester	4th Semester	5th Semester	6th Semester	7th Semester	8th Semester
1	MATH110 Mathematics I 6 CP (3 UoIL, 3 UoIR)	MATH120 Mathematics II 8 CP (4 UoIL, 4 UoIR)	MECH210 Engineering Mechanics II (Dynamics) 4 CP (2 UoIL, 2 UoIR)	EEEJ221 Measurement, Instrumentation and Control Basics 4 CP (2 UoIL, 1 UoIR, 1 UoILab)	EEEE311 Electrotechnical Materials 4 CP (2 UoIL, 2 UoLab)	EEEJ321 Renewable Energy System 4 CP (2 UoIL, 2 UoIR)	EEEE 411 Transmission and Distribution Engineering 6 CP (2 UoIL, 4 UoIR) Project	EEEE 421 Power Systems Planning Operation and Control 6 CP (2 UoIL, 2 UoIR, 2 UoILab)
2								
3								
4								
5			STAT210 Introduction to Statistic 4 CP (2 UoIL, 2 UoIR)	CAD220 Computer Aided Design (CAD) 4 CP (1 UoIL, 3 UoILab)	EEEM 312 Mechatronics and Controllers 4 CP (2 UoIL, 2 UoILab)	EEEM 322 Power Electronics 4 CP (2 UoIL, 2 UoILab)		
6								
7	CHEM110Chemistry 5 CP (3 UoIL, 2 UoIR)						EEEE 412 Embedded Systems 4 CP (2 UoIL, 2 UoIR) Project	EEEE 422 Power System Relaying & Protection 6 CP (2 UoIL, 2 UoISem, 2 UoILab)
8								
9		MATS120 Materials Science 4 CP (2 UoIL, 2 UoIR)	THER210 Engineering Thermodynamics 4 CP (2 UoIL, 2 UoIR)	FLME220 Fluid Mechanics 4 CP (2 UoIL, 2 UoIR)	EEEM 313 Control Systems 4 CP (2 UoIL, 2 UoIR)	EEEM 323 Electric Machines and Drive 4 CP (2 UoIL, 2 UoILab)		
10								
11							EEEE 413 Power Plant Engineering 6 cp (2 UoIL, 2 UoIR 2 UoILab) Project	
12	GEOS110 Introduction to Geosciences 4 CP (2 UoIL, 2 UoIR)							
13		MECH120 Engineering Mechanics I (Statics) 4 CP (2 UoIL, 2 UoIR)	DESN210 Engineering Design 4 CP (1 UoIL, 3 UoIR)	RREC220 Raw Materials & Recycling 4 CP (2UoIL, 2UoIFt)	EEEE 314 Electronics 6 CP (2 UoIL, 2 UoLR, 2UoILab)	EEEM 324 Digital Signal Processing 4 CP (2 UoIL, 2 UoIR)		THES420 Bachelor Thesis + Colloquium 12 CP
14								
15								
16	EEEJ111 Algorithm and Programming 4 CP (1 UoIL, 3 UoIL)							
17		PHYS120 Physics 6 CP (1 UoIL, 1 UoIR, 4 UoILab)	EEEJ211 Introduction to Electrical Engineering 4 CP (2 UoIL, 2 UoIR)	SCIM220 Scientific Methods 2 CP (2 UoIR)		EEEE 325 High voltage engineering 6 CP (2 UoIL, 2 UoIR, 2 UoILab)	STWR410 Scientific Writing 4 CP (2 UoIR)	
18								
19				HSE220 Health-Safety-Environment 4 CP (2 UoIL, 1 UoIR, 1 UoIIFt)	EEEE 315 Energy Storage & Conversions 4 CP (2 UoIL, 2 UoIR)			
20	ENSO110 Engineer in Society 2CP (2 UoIR)							
21			MINE210 Introduction to Mining 4 CP (2 UoIL, 1 UoIR, 1 UoIFt)				PROJ420 Final Study Project 6 CP (2 weeks + report + presentation + excursion) (2 UoIR, 2 UoIFt)	
22	PROJ110 Engineering Project 2 CP (2 UoIR)							
23		CHEM120 Chemistry Lab 3 CP (3 UoIL)		LAW220 Law 2 CP (2 UoIR)	EEEE 316 Circuit Analysis 6 CP (2 UoIL,3 UoIR, 1 UoLab)	INTR320 Industrial Internship + Reflection 10 CP 14 weeks		Electives
24	ENGL110 Technical English 4 CP (4 UoIR)							
25			ECON210 Introduction to Economics 4 CP (2 UoIL, 2 UoIR)	INTR220 Basic Internship 2 CP				
26		IEMB120 Introduction to Engineering Management & BA 4 CP (2 UoIL, 2 UoIR)						
27				Electives			Electives	
28	TIME110 Time Management 2 CP (2 UoIR)							
29			Electives		Electives			
30	Electives	INCC100 Intercultural Comm & Competence 2 CP (2 UoIR)						
31								
32								
Total CP	**31**	**31**	**28**	**30**	**30**	**32**	**30**	**28**

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 subjects in such a way that participation in his program-related modules is not endangered or restricted.**

****** The total amount of CP's from Electives has to be minimium 24.**

GENERAL ENGINEERING MODULE (1ST – 4TH SEMESTER)

MATH110 – MATHEMATICS I

Module title	Mathematics			**Module code**	MATH110
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	6 CP	**Workload**	180 h	**Contact hours**	72 h
				Individual study	108 h
Syllabus	• 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	*Anton, H. and Rorres, C. (2014) Elementary linear algebra, 11th edition, Wiley* *Kenneth, J.R. (2011) Discrete mathematics and its applications, 7th edition, McGraw-Hill Education* *Stewart, J. (2020) Calculus: Early Transcendentals, 9th edition, Brooks Cengage Learning* *Thomas' calculus (2017), 14th edition, Pearson Education*				
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%.				

CHEM110, CHEM120 – CHEMISTRY AND CHEMISTRY LAB

Module title	Chemistry and Lab			**Module code**	CHEM110, CHEM120
Duration	2 semesters	**Semester**	Fall & Spring	**Module start**	1st & 2nd
Credit points	6 CP (5 CP+3 CP)	**Workload**	180 h	**Contact hours**	72 h
				Individual study	108 h
Syllabus	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 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				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Apply chemical nomenclature to chemical compounds. 2. Apply the stoichiometric calculation of chemical reaction 3. Explain and apply the atomic structure of chemical elements and chemical bonds of molecules. 4. Using chemical equilibrium concept, you will also explain how urban smog forms and how reaction conditions can be altered 5. Describe and solve the kinetics of chemical reactions and interpret experiments on the kinetics of reactions. 6. Apply the basic concepts of analytical chemistry in chemical analysis 7. Balance redox reactions, explain the electrochemical reaction, and design & apply electrochemical cells. 8. Apply the acquired basic definitions of thermodynamics in thermodynamic systems. 9. Describe the structure, properties and synthesis of hydrocarbons & polymers. Apply the acquired knowledge, solve the problems 10. Interpret and apply the basic concepts of nuclear chemistry and explain the nuclear reactions.				

	11. Apply the acquired knowledge and team work skill, and presentation skill.
Literature	*Silberberg, M. Chemistry – Molecular Nature of Matter and Change, 6th edition, McGraw-Hill Education Atkins, P. and Jones, L. (2013) Chemical principles, 6th edition, W.H.Freeman* *Brown, L.S. and Holme, T. (2011) Chemistry for Engineering Students, 2nd edition, Cengage Learning*
Form of teaching	Lecture (3 UoI) Recitation (2 UoI) Laboratory (3 UoI)
Assessment method	Written examination (120 min.) and academic performance for an 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 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%.

GEOS110 – INTRODUCTION TO GEOSCIENCE

Module title	Introduction to Geoscience			**Module code**	GEOS110
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	**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	**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. **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. **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. **Earth's climate and soils** On successful completion of this module, the students should be able to: 1. Describe and differentiate the distribution of basic soil types on Earth 2. Recall the fundamentals of the global atmospheric circulation system and orbital parameters 3. Recall and identify the basic processes of pedogenesis 4. Summarise the distribution of climate and ecological zones on Earth 5. Evaluate the role of soils in context of ecology and land use
Literature	*Klein, C. and Philpotts (2012) Earth Materials: Introduction to Mineralogy and Petrology.* *Wenk, H.-R. and Bulakh, A. (2004) Minerals: Their Constitution and Origin.* *Mukherjee, S (2011) Applied Mineralogy Applications in Industry and Environment.* *Grotzinger, J., Jordan, T.H., Press, F. and Siever,R. (2010) Understanding Earth. 6th edition.* *Hamblin, W.K. (2004) Earth's dynamic systems.* *Evans (1993) Ore geology and industrial minerals.*
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)
Assessment 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%.

EEEJ111 –ALGORITHM AND PROGRAMMING

Module title	Algorithm and Programming			**Module code**	EEEJ111
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	This course comprises the following topics: • Introduction of Programming Languages (programs and programming. syntax, programming process, structure, executing and debugging); • Basic of programming (keywords, identifiers, 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 and string (variables and functions) • Functions (C: user-defined and system defined; C++: inline, friend, virtual				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe abstract data types used in C/C++ and explain their usage 2. describe commonly used syntactic constructions used in C/C++ 3. Develop programs and application 4. Implement a variety of algorithms for searching and sorting, including linear search, binary search, insertion sort, selection sort, merge sort, quicksort, and heap sort. 5. Apply knowledge in major courses and practical 6. Solve problems 7. Work independently				
Literature	*Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo, (2012) C++ Primer, Fifth Edition.* *Al Kelley and Ira Pohl, (1998), 4th Edition A Book on C: Programming in C.*				
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%.				

ENSO100 – ENGINEER IN SOCIETY (ETHICS)

Module title	Engineer in Society (Ethics)			**Module code**	ENSO100
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	Team teaching: The role of the engineers in the society; focus on science and responsibility.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Differentiate between basic tenets of engineering science, natural science, and the humanities and to 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	*Martin, M.W. and Schinzinger, R. (2010) Introduction to Engineering Ethics.* *Rees, M. (2004) Our final hour, Basic Books.* *Lawler, R. (2013) Engineering in Society, Royal Academy of Engineering.*				
Form of teaching	Lecture (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				
rading system	Pass/ Fail				

PROJ110 – ENGINEERING PROJECT

Module title	Engineering Project			**Module code**	PROJ110
Duration	1 week + report	**Semester**	Fall	**Module start**	1st
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	During the project, students work in small groups on an interdisciplinary assignment. Each student contributes to producing an interdisciplinary solution by working as a team with the resources from their individual disciplinary perspectives. The students of mechanical engineering experience the way an engineer deals with problems, they construct in methodology way and solve complex engineering tasks. The assignment is given out at the beginning of the project. Trained support staff accompanies the groups during the course of the project and encourages the development of social and subject-related skills.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Produce a goal-oriented solution through interdisciplinary teamwork. 2. Comprehend and work on an interdisciplinary assignment using design principles of mechanical engineering. 3. Moderate team processes. 4. Plan, organize and carry out tasks independently. 5. Discuss possible solutions and to reach a decision that is guided by criteria 6. Acquire competence in applying scientific methods and to 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				
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				

ENGL100 – TECHNICAL ENGLISH

Module title	Technical English			**Module code**	ENGL100
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	This course focuses on English as it is used in academic and professional scientific fields (mathematics, chemistry, and physics) and in technical fields that emphasize relevant sub-disciplines of engineering (mechanical, civil, electrical, geological, environmental, and industrial). It covers the vocabulary, concepts, and the particular grammatical structures used in scientific and technical communications in English, and in the process, all four language skills (reading, writing, listening, speaking) are practiced. This module is to help students to better understand the Lecturers and course material in the upper level/more advanced classes at GMIT, and in their future academic and/or professional careers.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Demonstrate understanding of, and properly express: 2. abbreviations, root meanings, and definitions of scientific and technical symbols, words, and phrases; describe graphs, equations, and technical processes; effectively communicate the operation of machines, instruments, and the underlying concepts involved, using appropriate scientific and technical terminology and structures. 3. Read a variety of science and technology texts at a high- intermediate level, to understand some technical details and identify the core meanings, in order to summarize the information in your own words 4. Follow and grasp the main points in audio and video material at a high-intermediate level, on a variety of topics in science and technology. 5. Successfully and effectively communicate both orally and in writing on a number of scientific and technical topics, using stylistic structures typical of technical English, by giving short presentations and responding effectively to questions about the topic.				
Literature	*Amling, Barbara et al. (2011) English for Mechanical Engineers. Coursebook, Cornelsen* *Supplementary materials related to topics covered*				
Form of teaching	Recitation (4 UoI)				
Assessment method	Written examination (70), in-class oral examination (15 minutes), academic performance during the semester				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronic Engineering				
Prerequisites for participation	English C1 level				
Requirements for receiving credit points	Passing the module				
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.				

TIME110 – TIME MANAGEMENT

Module title	Time Management			**Module code**	TIME110
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	2 CP	**Workload**	48h	**Contact hours**	16 h
				Individual study	32 h
Syllabus	The students will be introduced to time management and self-development skills. • Time management for successful school life • Shaping thinking frame • Values & purpose of life • Prioritizing tasks and 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 in their life for time management 2. Identify greatest time wasters and avoid them 3. Apply time management skill for effective school life. 4. Prioritize tasks and organize their life. 5. Develop and align their long- and short-term objectives. 6. Find inspiration which motivates them to focus on study. 7. Apply reading skills for their study.				
Literature	Scripts				
Form of teaching	Lecture & workshop				
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. Mechatronics Engineering				
Prerequisites for participation	None				
Requirements for receiving credit points	Passing the thesis and the presentation				
Grading system	Pass/Fail				

INCC100 – INTRODUCTION TO INTERCULTURAL COMMUNICATION AND COMPETENCE

Module title	Introduction to Intercultural Communication and Competence			**Module code**	INCC100
Duration	1 semester	**Semester**	Spring	**Module start**	1st
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	This required course, designed for the non-major, is to provide students with the theoretical background and applied skills to successfully navigate their undergraduate studies, campus life, required internships, and study abroad opportunities in GMIT's multi- cultural environment. This course will also help students be competitive in their future careers, either in an increasingly multicultural workforce in Mongolia, or abroad. In this course students learn about the elements of culture, its importance, the major causes of intercultural misunderstandings… and how they can be prevented or resolved. This is accomplished by: examining critical incidents (video, case readings), through discussions, and by applying various models of intercultural communication and competence, including the works of E.T. Hall and G. Hofstede.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Recognize and cope with sensitive cultural particular and respond to these differences in an appropriate and tactful manner. 2. Understand their own cultural background and values. 3. Evaluate and classify the behavioral and communication characteristics of several other cultures. 4. Apply effective intercultural argumentation and communication strategies. 5. Communicate in an appropriate manner in university, and daily situations in English. 6. Analyze intercultural incidents and apply problem-solving strategies. 7. Work effectively on intercultural teams.				
Literature	*Bennett, M. (1998). Basic Concepts of Intercultural Communication: Selected Readings, Intercultural Press, Inc.* *Glaser, Guilherme, Mughan (2007). Intercultural Competence for Professional Mobility, Council of Europe Press; Other materials pertinent to the topics*				
Form of teaching	Recitation (2 UoI)				
Assessment method	Presentation, discussions, final exam (30% performance, 70% exam)				
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				
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%.				

MATH120 – MATHEMATICS II

Module title	Mathematics II			**Module code**	MATH120
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	8 CP	**Workload**	240 h	**Contact hours**	96 h
				Individual study	144 h
Syllabus	• 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 differential equations: basic concepts and • Modeling, separable 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 differential equations; 4. Make use of mathematical models to solve complex scientific and engineering problems.				
Literature	*Stewart, J. (2020) Calculus: Early Transcendentals, 9th edition.* *Thomas' calculus (2017), 14th edition, Pearson Education*				
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%.				

MATS120 – MATERIALS SCIENCE

Module title	Materials Science			**Module code**	MATS120
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	**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	*Shakelford, J.F. (2015) Introduction to materials science for engineers, 11th edition.* *Anderson, J.C. and Leaver K.D. (1990) Material science ,4th edition.* *Callister, W.D. and Rethwish, D.G. (1990) Materials Science and Engineering, 9th edition.*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				

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%.

MECH120 – ENGINEERING MECHANICS I (STATICS)

Module title	Engineering Mechanics I (Statics)			**Module code**	MECH120
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	Definition of force, general systems of forces and equilibrium of rigid bodies, center of mass, reaction of the supports, statically determined system, trusses, beams, frames, curved beams, work principles, stability and friction				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Discern and explain the concept of force, moment and equilibrium. 2. Analyse statically determinate problems independently, i.e. to identify the forces, and determine their attack points and effects and formulate equilibrium conditions. 3. Ascertain the support reactions in statically determinate systems by means of equilibrium conditions or the principle of virtual work. 4. Compute internal forces and moments in beams and trusses. 5. Determine the equilibrium positions of a given movable system and investigate their stability. 6. Determine the equilibrium positions of a given movable system and investigate their stability. 7. Analyse static systems including static or kinetic frictions and calculate corresponding forces. 8. Analyse statically determined and statically undetermined systems of bars.				
Literature	*Meriam, J. L. and Kraige, L. G. (2013) Engineering Mechanics. Statics, 7th edition, Wiley India* *Gross, D., Hauger, W., Schröder, J., Wall, W.A. and Rajapakse, N. (2009) Engineering Mechanics 1. Statics, Springer-Verlag*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment 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%.				

PHYS120 – PHYSICS

Module title	Physics			**Module code**	PHYS120
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	2 CP + 4 CP	**Workload**	180 h	**Contact hours**	72 h
				Individual study	108 h
Syllabus	**Oscillations** • Damped and forced oscillations in mechanical and electrical systems • Wave propagation: mechanical and light waves • Superposition of waves, standing waves and resonance • Coupled oscillations **Waves** • Wave phenomena • Dispersion relation, phase and group speed • Wave phenomena: breaking, interference and bending • Doppler effect, electromagnetic waves **Optics** • Geometric optics, beam optics, optical instruments • Light sources (thermal emitters, gas dischargers, LEDs, lasers) • Spectroscopy **Atomic and nuclear physics** • Bohr's model of the atom, radioactivity					
Learning outcomes	On successful completion of this module, the students should be able to: **Lecture and Seminar:** 1. Describe the characteristic features and properties of oscillations and waves, and identify these features by means of different systems. 2. Apply the relevant physical laws that describe oscillations and waves in various problems. 3. Describe characteristic wave phenomena and identify them in a variety of systems. 4. Describe the principles of geometrical optics and their application in optical instruments, and apply these principles to the design of simple optical components. 5. Describe and apply the main methods of measurement and analysis in the fields of mechanics, oscillations and waves, electromagnetism and optics. 6. Describe the basic principles of data recording, evaluation and interpretation, and apply them to experimental physical problems. **Laboratory:** 1. Describe and apply the main methods of measurement and analysis in the fields of mechanics, oscillations and waves, electromagnetism and optics. 2. Describe the basic principles of data recording, evaluation and interpretation, and apply them to experimental physical problems 3. Work in teams on the scientific content of the syllabus, in order to consolidate their understanding of selected physical phenomena. 4. Carry out experiments using equipment without assistance. 5. Record and document the results of the experiments					
Literature	*Freedman, Y. University Physics with Modern Physics, 13th edition.* *Crawford, F.S. Waves and oscillations.* *Fitzpatrick, R. Oscillations and Waves: An Introduction.* *Hecht, E. Optics.* *Hecht, E. Schaum's Outline of Optics* *Bennett, C.A. Principles of Physical Optics.*					
Form of teaching	Lecture (1 UoI) Recitation (1 UoI) Laboratory (4 UoI)					
Assessment method	**Lecture and Seminar**: Written examination (120 min.) and academic performance					

	Laboratory: Oral examination (10 min) on the preparation of the experiment and presentation of the results (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	**Lecture and Seminar:** Passing the module “Physics laboratory” is a prerequisite for the participation of the final module examination **Laboratory:** Successful creation of the report on the experiment, passing the oral examination on the preparation of the experiment, and successfully carrying out the experiment and presenting the results.
Grading system	**Lecture and Seminar:** The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%. **Laboratory**: The final grade is based on the average of all the modules. The grade is based on experimental data and work (25%), analysis, data tables, calculations, graphs, etc. (40%), conclusions (20%) and answers to questions (15%).

IEMB120 – INTRODUCTION TO ENGINEERING MANAGEMENT AND BUSINESS ADMINISTRATION

Module title	Introduction to Engineering Management and Business Administration			**Module code**	IEMB120
Duration	1 semester	**Semester**	Spring	**Module start**	2nd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	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	*Robbins, S.P., Coulter, M. (2012) Management, 11 Edition, Pearson* *Wöhe et al (2020) Einführung in die Allgemeine Betriebswirtschaftslehre, 27th Edition, VAHLEN, Munich* *Talya Bauer, Berrin Erdogan and Jeremy Short (2019) Principles of Management Version 4.0. Boston Academic Publishing Inc., d.b.a FlatWorld*				
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%

MECH210 – ENGINEERING MECHANICS II (DYNAMICS)

Module title	Engineering Mechanics II (Dynamics)			**Module code**	MECH210
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	Kinematics of points and rigid bodies, relative kinematics, kinetics of rigid bodies, work and energy, vibrations, impact, principles of mechanics (d'Alembert's principle, Lagrange's equations).				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe planar and spatial motions of point masses and rigid bodies. 2. Analyze dynamical problems and to derive the equations of motion for simple mechanical systems 3. Apply Newton´s and Euler´s laws in order to solve dynamical problems 4. Model simple vibration systems and to solve simple differential equations. 5. Apply the principles of mechanics to simple problems.				
Literature	*Meriam, J. L. and Kreige, L.G. (2013) Engineering Mechanics. Dynamics, 7th edition, Wiley India*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment 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%.				

STAT210 – INTRODUCTION TO STATISTICS

Module title	Introduction to Statistics			**Module code**	STAT210
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	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	*Navidi, W. (2008) Statistics for engineers and scientists, 3rd edition.* *Ott, R.L. and Longnecker, M. (2010) An introduction to statistical methods and data analysis, 6th edition.* *Walpole, R.E. (2012) Probability and statistics for engineers and scientists, 9th edition.* *Ross, S. (2008) A First Course in Probability. 8th edition.* *Triola, M. (2018) Elementary Statistics. 13th edition.* *Martinez, W. (2015) Statistics in Matlab: Premier. 1st edition.* *Bertsekas, D. (2000) Introduction to Probability. Lecture note on Course 6.041-6.431 in MIT.*				
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%.				

THER210 – ENGINEERING THERMODYNAMICS

Module title	Engineering Thermodynamics			**Module code**	THER210
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	Fundamental terms of thermodynamics; thermodynamic equilibrium and temperature; different forms of energy (internal energy, heat, work, enthalpy); properties and equations of state for gases and incompressible substances; first law of thermodynamics and energy balances for technical systems; second law of thermodynamics and entropy balances for technical systems; exergy analysis; 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	*Cengel, Y. and Boles, M. (2014) Thermodynamics: An Engineering Approach, 7th edition.* *Koretsky, M.D. (2012) Engineering and Chemical Thermodynamics, 2nd edition.*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment 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%.				

DESN210 – ENGINEERING DESIGN

Module title	Engineering Design			**Module code**	DESN210
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	The module will deal with the principles of product development and their representation in technical terms, and with selected aspects of the geometrical representation: elements of product design and development, different types of notation, multi-plane projections, cutaways and developed views, introduction to standardization, tolerances, limits and fits, basics of design for batch production				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Interpret and assess basic technical relationships. 2. Describe simple technical objects and represent them in a drawing. 3. Explain the principles of technical construction (tolerances, limits and fits, spring elements, etc.), and apply them to the development and construction of components.				
Literature	*Gieseke et. al.: Technical Drawing with Engineering Graphics, International Edition, 14th edition.* *Mottetal: Machine Elements in Mechanical Design, 4th edition.*				
Form of teaching	Lecture (1 UoI) Recitation (3 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%.				

EEEJ211 – INTRODUCTION TO ELECTRICAL ENGINEERING

Module title	Introduction to Electrical Engineering			**Module code**	EEEJ211
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	Electrical charge, electrical current, electrical voltage and power, linear DC circuits, Ohm's law, Kirchhoff rules, ideal and real sources, electrical field, capacitor, electrostatic forces, capacitors in linear networks, magnetic field, Lorentz force, Ohm's law of the magnetic network, Ampere's circuital law, ferromagnetism, induction, 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	*Cathey J.J. and Nasar, S.A. (1984) Basic Electrical Engineering, McCraw-Hill Education Theraja B.L. and Theraja A.K. (2005) A textbook of electrical technology, Volume I Basic Electrical Engineering In S.I. System Of Units, S. Chand & Company Ltd., New Delhi, India*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment 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%.				

MINE210 – INTRODUCTION TO MINING

Module title	Introduction to Mining			**Module code**	MINE210
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	Introduction to the terminology and symbols used in mining. The importance of surface mining for extracting raw materials: stages in surface mining, the influence of deposits and rock parameters on the selection of machinery, principles of formation of technological chains for the main processes of extraction, loading, transporting, and tipping and, where necessary, crushing and storage. Basic technologies for surface mining: spatial development of an excavation, introduction to the technology of large-scale open-cast mining, basic calculations, and sample case studies, practical work in extraction by cutting. The part-processes for underground mining will also be described, and their respective interdependency, technical process chains, the scale of the operations, department sizes, extraction, and transportation processes, selection criteria for equipment, and organization of the processes.				
Learning outcomes	On successful completion of this module, students should be able to: 1. Recognize the machines and technologies used in open pit and underground mining. 2. Identify the principles of the technologies covered, and influence the factors for their application. 3. Choose appropriate technologies for given circumstances. 4. Calculate the main parameters of simple technological chains.				
Literature	*Hartman, H. and Mutmansky, J.M. (2015) Introductory Mining Engineering, John Wiley & Sons* *Darling et. al. (2011) SME Mining Engineering Handbook, Society for Mining, Metallurgy, and Exploration.* *Hustrulid, W.A. (2013) Open Pit Mine Planning and Design, CRC Press.* *Stoll, R.D. et. al. (2009) Der Braunkohlentagebau, Springer.*				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Field trip (1 UoI)				
Assessment method	Written examination (90 min.) and academic performance (tests and participation in the practical lab work and in a field trip to a surface mining operation)				
Associated study program	B.Sc. 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%.				

ECON210 – INTRODUCTION TO ECONOMICS

Module title	Introduction to Economics			**Module code**	ECON210
Duration	1 semester	**Semester**	Fall	**Module start**	3rd
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	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 influences the elasticities of demand and supply. 4. Explain what a firm is and describe the economic problems that all firms face, describe and distinguish between different types of markets in which firm operates. 5. Explain the relationship between a firm's output and labor employed in the short run, explain the relationship between a firm's output and costs in the short run and derive a firm's short-run cost curves, and explain the relationship between a firm's output and costs in the long run and derive a firm's long-run average. 6. Define perfect competition, monopoly, monopolistic competition and oligopoly, explain how firms make their supply decisions in these markets, and why perfect competition is efficient and why others are inefficient. 7. Explain the link between a factor price and factor income, explain what determines demand, supply, the wage rate, and employment in a competitive labor market, and explain what determines demand, supply, the interest rate, saving, and investment in the capital market.				
Literature	*Atkinson, B. and Miller, R. (1998) Business Economics.* *Parkin M. (2016), Economics, 12th edition* *N.Gregory, Mankiw, Principles of Economics, 7th edition*				
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%.				

EEEJ221 – MEASUREMENT, INSTRUMENTATION AND CONTROL BASICS

Module title	Measurement, Instrumentation and Control Basics			**Module code**	EEEJ221
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	• Measurement technology: physical significance, measuring arrangement, measurement chain, errors, the main procedures for measuring temperature, pressure, flow and filling levels • Data-processing technology: measuring transducers, measured value boards (hardware), measurement software, processing and analysis 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	*Cain, M.C., Tesar, J. and Veghel, M. Springer Series in Measurement Science and Technology.* *Rossi, G.B. (2014) Probabilistic Theory of Measurement with Applications.* *Hebra, A. (2010) The Physics of Metrology.* *Physical and Chemical Metrology Impact and Analysis (2002) ASQ Quality Press.* *Pennella, C.R. (1997) Managing the Metrology Systems, ASQ Quality Press.*				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Laboratory (1 UoI)				
Assessment 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%.				

CAD220 – COMPUTER AIDED DESIGN (CAD)

Module title	Computer Aided Design (CAD)			**Module code**	CAD220
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	Current CAD developments, modelling and modelling strategies, Computer Aided Design using software tools like AutoCAD, Lumion 3D, 3Ds MAX, Edius 7 • Working Space and Commands • Basic drawing skills using CAD, Drawing Aids, Editing Entities • Layers, Dimensioning and Hatching • Working groups, dynamic blocks, data attributes (AutoCAD Designer) • 3D isometric drawings, 3D Gizmo Editing, Rendering of solid models • Modeling Techniques, 3Dwalk and 3Dfly • 3D Printing and Animation				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe and apply CAD and modelling systems. 2. Classify the development of CAD processes.				
Literature	*The literature depends on computer programs (AutoCAD, CATIA, PROEngineer) chosen, on-line tutorials are available* *Lang, K. (2013) AutoCAD Tutor for Engineering Graphics, Delmar* *Dix, M. and Riley, P. (2015) Discovering AutoCAD, Pearson*				
Form of teaching	Lecture (1 UoI) Laboratory (3 UoI)				
Assessment 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 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%.				

FLME220 – FLUID MECHANICS

Module title	Fluid Mechanics			**Module code**	FLME220
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	Properties of fluids, flow kinematics, conservation equations, constitutive equations, equations of motion, hydrostatics, turbulent flows.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the origins and limitations of the basic conservation equations of fluid mechanics (mass, momentum, moment of momentum, energy). 2. Choose the correct equations, simplifications and boundary conditions for a given application and recognize avenues for solution. 3. Calculate pressure losses for simple flow networks.				
Literature	*Elger, D.F.; Williams, B.C.; Crowe, C.T. and Roberson, J.A. (2012) Engineering fluid mechanics, 10th edition.*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (180 min.) and academic performance				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering 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%.				

RREC220 – RAW MATERIAL AND RECYCLING

Module title	Raw Material and Recycling			**Module code**	RREC220
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	• The technical and legal principles will be covered in relation to selected topics in raw material management and recycling: • Legal principles (material-specific and country-specific). • Quantities of waste material and primary raw material. • Raw material prices and recycling costs. • The market for secondary raw materials. • Quality requirements, and basic technical principles. • Examples of recycling processes. • Current legal requirements, and the effects and repercussions upon trade, industry, and local authorities. • Demonstration of various different economic measures for recycling by means of practical examples. • Cycles will be considered in the following industrial sectors: iron and steel, non-ferrous metals, mineral raw materials, and wood.				
Learning outcomes	On successful completion of this module, students should be able to: 1. Describe the technical and economic principles of lifecycle economy, recycling, and the identification and remediation of contaminated sites. 2. Explain the technical relationships, the differences between free and regulated markets, and the controlling function of the legal system in recycling, and the remediation of contaminated sites. 3. Apply the gained knowledge by carrying out a piece of independent practical work, and publicly presenting their knowledge and experience of complex technical/economic/legal matters.				
Literature	*Bilitewski, B. (2010) Waste Management. Springer.* *Pichtel, J. (2014) Waste Management Practices. CRC Press.* *Rowe, D.R. (1995) Handbook of Wastewater Reclamation and Reuse, Lewis* *Bagchi, A. (2004) Design of Landfills and Integrated Solid Waste Management. Wiley.*				
Form of teaching	Lecture (2 UoI) 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%.				

SCIM200 – SCIENTIFIC METHODS

Module title	Scientific Methods			**Module code**	SCIM220
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	This topic introduces students to the broad quantitative and qualitative approaches to research in the field of education. Students examine the key steps in the process of conducting research including identifying research problems, reviewing the literature, developing research questions, collecting and 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	*Alreck, P.L. and Settle, R.R. (1995) The Survey Research Handbook, Irvin/McGraw-Hill.* *Degrazia, D., Mappes, T. A. and Brand-Ballard, J. (2011) Biomedical Ethics. 7th edition, McGraw-Hill.*				
Form of teaching	Recitation (2 UoI)				
Assessment method	Academic performance and final paper				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering 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				

HSE220 – HEALTH SAFETY ENVIRONMENT (HSE)

Module title	Health Safety Environment (HSE)			**Module code**	HSE220
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	48 h
				Individual study	72 h
Syllabus	**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, content 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	*Center for the Advancement of Process Tech, (2009) Safety, Health, and Environment, Prentice Hall PTR*				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Field trip (1 UoI)				
Assessment 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%.				

LAW220 – LAW

Module title	Law			**Module code**	LAW220
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	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	*Amarkhuu, O. (2013) Contemporary Environmental Law of Mongolia.* *Percival, R. V. (2013) Environmental Regulation: Law, Science and Policy, 7th edition.* *Hunter, H; Salzman, J. and Zaelke, D. (2011) International Environmental Law & Policy casebook, 4th edition*				
Form of teaching	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%.				

INTR220 – BASIC INTERNSHIP

Module title	Basic Internship			**Module code**	INTR220
Duration	1 semester	**Semester**	Spring	**Module start**	4th
Credit points	2 CP	**Workload**	6 weeks	**Contact hours**	
				Individual study	
Syllabus	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)

EEEE 311– ELECTROTECHNICAL MATERIALS

Module title	Electrotechnical Materials			**Module code**	EEEE311
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	Conducting materials, semiconductors Magnetic materials, dielectrics insulating materials, materials for special applications, modern techniques for materials studies, Ceramics Plastics				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Properties using the example of material of electrical Engineering: 2. Explain the significance of the main Material of electrical Engineering: 3. Explain the fundamentals of Material of Electrical Engineering: 4. Select materials in a responsible manner 5. Recognize and apply the significant properties for material of Electrical Engineering 6. Select electrical technical materials in a responsible manner On successful completion of the practical laboratory work, the students should be able to: 1. Prepare experiments using written instructions. 2. Carry out experiments unaided, in teams, and under partial instruction. 3. Present the results of the experiment in an appropriate manner.				
Literature	*Bhadra Prasad Pokharel and Nava Raj Karki,"Electrical Engineering Materials",Sigma offset Press,Kamaladi, Kathmandu, Nepal,2004.* *R.C. Jaeger,"Introduction to Microelectronic Fabrication- Volume IV", Addison Wesley publishing Company,Inc., 1988.* *Kasap.S.O, Principles of electrical engineering materials and devices, McGraw Hill, NewYork,2000.* *R.A.Colcaser and S.Diehl-Nagle,"Materials and Devices for Electrical Engineers and Physicists,McGraw-Hill, New York, 1985.*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (120 min.) and academic performance.				
Associated study program	B.Sc. Raw Materials and Process Engineering				
Prerequisites for participation	None				
Requirements for receiving credit points	Passing the module				
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.				

EEEM312 – MECHATRONICS AND CONTROLLERS

Module title	Mechatronics and Controllers			**Module code**	EEEM312
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	**Mechatronics**: Basic concepts of mechatronics, control of mechatronic systems; modelling of systems. **Introduction**: Concept of PLC, building block of PLC, function of various blocks, limitation of relays, advantage of PLC over electromagnetic relays, different programming languages, PLC manufacturer, working of PLC, basic operation and principles of PLC, architectural details **Instruction Set**: Basic instructions like latch, master control self-holding relays, timer instruction like retentive timers, resetting of timers, counter instructions like up counter, resetting of counters. Ladder Diagram Programming: programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder program) **Microcontroller series**: Pin details, I/O ports structure, memory organization, special function registers instruction set, addressing modes, timer's operation, serial port operation, interrupts **Keil language programming**: Assemblers and Compilers, assembler directives, desi,gn and interface. Examples like: keypad interface, 7- segment interface, LCD, Stepper motor, A/D, D/A, RTC interface, the introduction of PIC microcontrollers. **Practical projects using PLC training and Microcontroller training, Computer Diagnostics Tools**				
Learning outcomes	On successful completion of this module, students should be able to 1. Operate and demonstrate microcontroller and PLC-based systems in electrical control circuits for domestic and industrial processes 2. Program and develop microcontroller-based systems 3. Use of PLC and make suitable ladder logic programs for different applications 4. Understand various control system devices and components the performance of various controllers, and control system				
Literature	*Gary Dunning, Introduction to Programmable Logic Controllers, 3rd Edition* *Programmable Logic Controller and Microcontrollers, Umesh Rathore, 2016*				
Form of teaching	Lecture (2 UoI) Laboratory (2 UoI); Project				
Assessment method	Written examination (180 min.) and academic performance and project assessment.				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Mechatronics Engineering				
Prerequisites for participation	Fundamentals of Electrical 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%.				

EEEM313 – CONTROL SYSTEM

Module title	Control System			**Module code**	EEEM313
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	• Open and closed loop systems (basic properties, mathematical representations); • Transfer functions, block diagrams, signal flowing chart (input, output), state space models • Responses in time domain and frequency domain • Stability criterions, root locus analysis, Nyquist analysis and analytic analysis • Design and corrections of control systems (analyses and syntheses) • Applications (PID controllers and filters)				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Recall properties, theorems and mathematical representations of open and closed loop systems 2. Define behaviours of the transient and steady-state responses of systems (first order, second order, integral and derivative) 3. Derive transfer functions of systems 4. Sketch responses in time domain and frequency domain 5. Apply knowledge in design of control systems and filters 6. Solve problems related to control systems by using Matlab				
Literature	*Farid Golnaraghi, Benjamin C. Kuo, (2017) Automatic Control Systems, Tenth Edition. Orchard Publications (ninth edition is free in online).*				
Form of teaching	Lecture (2 UoI) Reciation (2 UoI)				
Assessment method	Written (90 min.) and oral (30 min per each student.) examination and academic performance				
Associated study program	B.Sc. Mechatronic Engineering B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Completion of Introduction to Electrical Engineering, Fundamentals of 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%.				

EEEE314 – ELECTRONICS

Module title	Electronics			**Module code**	EEEE314
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Syllabus	Analog and digital electronic components as integral parts of Mechatronic Systems. Basics of linear circuits with resistors, capacitors and inductor **Analog Electronics:** • Semiconductor Electronic Devices. Semiconductor materials (Si, Ge) and their electrical conductive properties • .Components of analog electronic circuits: • Switching Devices: Diodes, (Bipolar)-Transistors, Metal Oxide Semiconductor Field Effect Transistors (MOSFET). • Operational Amplifiers (op-amps): with operation to add, subtract, multiply, compare, convert, etc. Examples: Basic op-amps, Common op-amps, e.g. comparator, positive feedback, negative feedback, etc. • Filter: Low pass, high pass, band pass, band stop and all-pass filters. • Modelling, Design, Construction and Debugging of Analog Electronic circuits. Basic principles of operation. Basic properties, Transistor models and higher frequencies, Properties and applications of Operational Amplifiers, Circuit Simulation with SPICE, Small signal modelling, Single Stage Amplifiers, Frequency Response of of analog electronic circuits. **Digital Electronics:** • Presentation of the most popular Digital Electronic Device types, e.g. the Complementary Metal Oxide Silicon (CMOS). Consideration of Power consumption, Voltage levels and Speed of operation. Explanation of Logic Devices .The most common logic gates: Decoders, Multiplexer and Flip Flops. Boolean Algebra, • Analog-Digital-Converters (ADC) to convert Analog signals to Digital numbers (e.g. from Sensor to Microcontroller) and Digital-Analog-Converters (DAC) to convert Digital numbers to Analog signals (e.g. Microcontroller to Actuator). Resolution of ADCs and DACs, Error quantification.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Recall properties, theorems and mathematical representations of open and closed loop systems 2. Define behaviours of the transient and steady-state responses of systems (first order, second order, integral and derivative) 3. Derive transfer functions of systems 4. Sketch responses in time domain and frequency domain 5. Apply knowledge in design of control systems and filters 6. Solve problems related to control systems by using Matlab				
Literature	*R. Isermann: Mechatronic Systems, Springer Verlag (2003)S. Centinkunt: Mechatronics, John Wiley&Sons (2005)*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI) Laboratory (2 UoI)				
Assessment method	Written examination (180 min.) and academic performance.				
Associated study program	B.Sc. Mechatronics B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Completion of Physics, Introduction Electrical Engineering or Fundamentals of Electrical Engineering, Material Science, Introduction to Computer 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%.

EEEE 315 – ENERGY STORAGE AND CONVERSION

Module title	Energy Storage and Conversion			**Module code**	EEEE315
Duration	1 semester	**Semester**	Fall	**Module start**	5th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	• Necessity of energy storage, especially with regard to Renewable Energies • Application areas for electrical and thermal energy storage: portable devices, consumer products, industrial processes, solar systems, power grids, vehicles • High-and low-temperature thermal storage systems • Mechanical systems for electrical energy storage: flywheel, pumped storage, compressed air energy storage, hydroelectrical stations • Electric storage (inductors, capacitors, supercapacitors) • Electrochemical energy storage for electrical energy: primary batteries, rechargeable electrochemical energy storage • Various types batteries: Lead-acid, Lithium-Ion, NiCd and others Hydrogen Storage Systems • Hydrogen Storage Systems • Feasibility studies for various applications, eg storage in power grids • Economic analysis of energy storage systems • Completion of case studies for big storage systems • Safety aspects, recyclability • Conversion of mechanical energy • Conversion of thermal energy • Energy conversion without thermal energy • Structure of transformation unit				
Learning outcomes	On successful completion of this module, students should be able to: 1. Understand various technologies of energy storage and storage systems 2. Evaluate various storage systems and calculate and size the components of a storage system 3. By the use of an universal storage model, independently of the used technology, they can solve various energy storage problems.				
Literature	*Energy Storage, Huggins, Springer Verlag, ISBN 978-1-4419-1024-0* *Francisco Diaz-Gonzales, Andreas Sumper, Energy Storage in Power Systems, (Wiley, 2016)*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (120 min) and academic performance and project assessment				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Introduction to Electrical Engineering				
Requirements for receiving credit points	Passing the module				
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%.				

EEEE316 – CIRCUIT ANALYSIS

Module title	Circuit Analysis			**Module code**	EEEE316
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Syllabus	• First and second order circuits and transient state • Magnetically coupled circuits and transient state • Static magnetic field (permeability and saturation, electromagnetic induction) • Dynamic magnetic field (Maxwell) • Thevin and Norton AC analysis, Transient Response of DC & AC and Magnetically Coupling electrostatic field • Project				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Recognize the link between electricity and magnetism 2. Know the different types of fields and their definitions 3. Calculate linear magnetic circuits 4. Calculate inductivity, capacity and resistance of simple geometric arrangements and now understand these sizes as a physical property of each arrangement 5. Know the system of Maxwell's equations and can transfer them from the integral to the differential form				
Literature	*Charles K. Alexander | Matthew n. o. Sadiku (2011) Fundamentals of Electric Circuits, 5th Edition* *Theraja B.L. and Theraja A.K. (2005) A textbook of electrical technology, Volume I Basic Electrical Engineering In S.I. System Of Units, S. Chand & Company Ltd., New Delhi, India*				
Form of teaching	Lecture (2 UoI) Recitation (3 UoI) Laboratory (1 UoI)				
Assessment method	Written examination (90 min.) and academic performance.				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Fundamentals of Electrical Engineering I				
Requirements for receiving credit points	Passing the examinition				
Grading system	The final grade consists of the academic performance during the module accounting for 70% and the module examination accounting for 30%.				

EEEJ321 – RENEWABLE ENERGY SYSTEMS

Module title	Renewable Energy Systems			**Module code**	EEEJ321
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	This module introduces students to both conventional and renewable energy sources, energy generation techniques, and the efficiency of energy production and usage: • Conventional energy sources (fossil fuels, nuclear energy): raw material extraction, transport, and processing, typical techniques of conventional energy generation, environmental impacts (from resource extraction to energy production). • Renewable energy sources (hydropower, wind power, solar energy, and biomass): ecological advantages, challenges for implementation (cost, suitable locations, acceptance, and negative environmental impacts). • Efficiency at the energy supply side (efficiency factors, energy losses during combustion, transport, etc.). • Efficiency of energy usage in industry, at the municipal and domestic level (e.g. heating/insulation, the efficiency of electrical appliances, energy efficiency in the transportation sector). Student project: Assessment of energy efficiency at GMIT in Nalaikh				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the principles of the technical construction of renewable energy systems (Energy Sources, Solar Photovoltaic, Solar Tracking, Charge Controller and Inverter, Wind Power Systems, Wind Turbine Control, Biomass Technologies, Geothermal Power Generation, Energy from Water, Fuel Cells, Generators). 2. Describe the relevance of the energy production sector for environmental degradation and a sustainable future. 3. Critically reflect the advantages and disadvantages of different conventional and renewable energy sources and production techniques. 4. Assess the efficiency of energy production and consumption for typical examples from Mongolia (e.g. thermal power plants, insulation of buildings, transport sector). 5. Apply knowledge about the preconditions for an effective usage of energy system				
Literature	Demirel, Y (2016): E*nergy - Production, Conversion, Storage, Conservation, and Coupling*. Springer, London Buchla D.M., Kissel, T.E. and Floyd T.L. (2015) *Renewable Energy Systems*, Pearson				
Form of teaching	Lecture (2 UoI) Recitation (1 UoI)				
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. Energy & Electrical Engineering				
Prerequisites for participation	Introduction to Electrical Engineering				
Requirements for receiving credit points	Passing the module				
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%				

EEEM322 – POWER ELECTRONICS

Module title	Power Electronics			**Module code**	EEEM322
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	4CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	**Overview of power semiconductor devices**: Diodes, Thyristors, BJT, MOSFET, IGBT. **Rectifiers**: Single-phase and three-phase diode rectifiers with different types of loads, Average power output, Performance parameters, Harmonic analysis. **Switch-mode DC-DC converters**: Design, analysis and control of Step-down (Buck), Step-Up (Boost), Buck-Boost and Full bridge topologies, Pulse-width modulation (PWM) scheme, characteristics of controllable switches, continuous and discontinuous current mode. **Switch-mode DC-AC converters**: Basic inverter concept, Sinusoidal PWM. **Project: Practical Application**				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the static and dynamic characteristics of fundamental power semiconductor devices. 2. Explain the working principle of uncontrolled rectifiers and calculate the performance parameters from the average, RMS and peak values of the related circuit parameters. 3. Calculate harmonics in the output and input currents for rectifier operations. 4. Design and analyze various types of switched-mode DC converters. 5. Explain the control of power converters using pulse-width modulation (PWM). 6. Describe the basic working principle of switch-mode inverters, 7. Simulate simple power electronic circuits using simulation packages like Spice or MATLAB/Simulink. 8. Conduct experiments with converters and compare the results with theoretical concepts and simulations.				
Literature	*Hart, Daniel W. Power electronics. New York: McGraw-Hill, c2011*				
Form of teaching	Lecture (2 UoI) Laboratory (2 UoI)				
Assessment method	Written examination (120 min.) and academic performance				
Associated study program	B.Sc. Electrical Engineering-Energy B.Sc. Mechatronic Engineering				
Prerequisites for participation	Electronics				
Requirements for receiving credit points	Passing the examinations				
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.				

EEEM323 – ELECTRIC MACHINE AND DRIVE

Module title	Electric Machine and Drive			**Module code**	EEEM323
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	**Construction and operating mode of** • transformer • DC machine/drive • asynchronous machine/drive • synchronous machine/drive **Theory of rotating magnetic field** **Stationary operating behavior of the machines in engine/generator operatio** **Application in drive technology (mains fed / inverter feed).**				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Understand the fundamentals of electrical-mechanical energy conversion 2. Understand and explain the implementation of the basic concepts of Electromagnetic fields and forces in their application to electrical machines 3. Understand the individual components of electrical machines in their function and explain in their mode of action 4. Calculate and explain the stationary operating behaviour of the three basic types of electrical machines (DC machine, asynchronous machine, synchronous machine) in both generator and engine operation.				
Literature	*Control of Electric Machine Drive Systems - Seung-Ki Sul, IEEE Press and John Wiley, 2011.3. Electric Drives, an Integrative Approach, N. Mohan, MINPRE, 2003, ISBN 0-9715292-5-6.*				
Form of teaching	Lecture (2 UoI) Laboratory (2 UoI)				
Assessment method	Written examination (x min) and academic performance				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Energy & Electrical Engineering B.Sc. Mechatronics Engineering				
Prerequisites for participation	Circuit Analysis				
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%.				

EEEL324 – DIGITAL SIGNAL PROCESSING

Module title	Digital Signal Processing			**Module code**	EEEL324
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	**Basics of Digital Signal Processing** • Sampling and Quantization, Kotelnikov / • Nyquist–Shannon sampling theorem. • Amplitude, phase, frequency. • Periodic signals, aliasing. **Introduction to The Fourier Transform** • Properties of the Fourier Transform. • Digital Fourier transforms **Fast Fourier Transform algorithms** • FIT, DIT. Window functions. **Correlation Analysis** • Cross Correlation and Autocorrelation **Wavelet transforms** • Wavelet digital transform, Wavelet • continuous transform. Orthogonal basis. • Types of wavelets **Discrete Time Systems** • Filter classification in the frequency • domain, FIR and IIR filters. • Transfer function, Impulse Response, • Convolution. • Design of filters by windowing **The Z-transform** • Properties of the z transform. Poles, Zeros. • Pole-zero diagram and frequency response **Modulation and demodulation** • Amplitude and Angle Modulation. • Quadrature modulation. Deviation. • Spectral characteristics. **Digital Communication Systems** • PWM, Keying, Symbol rate, Constellation • and Scatter plots. QAM. Filter shaping. • Sigma-Delta modulation				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Identify and describe different techniques in modern digital communications, in particular in source coding, modulation and detection, carrier modulation, and channel coding. 2. Develop simple software, for example using Matlab, and use this software to simulate and analyze problems within the field, as well as report the development and results. 3. Describe and motivate the fact that the implementation and development of modern digital signal technology requires mathematical modeling and problem solving. 4. Apply mathematical modeling to problems in digital communications, and explain how this is used to analyze and synthesize methods and algorithms within the field.				
Literature	*Richard G. Lyons. Understanding Digital Signal Processing, Third Edition, Pearson Education, Inc, 2012. p.667. ISBN-13: 978-0-13-702741-5, ISBN-10: 0-13-702741-9* *A. V. Oppenheim and R. W. Schafer. Discrete-Time Signal Processing (Prentice-Hall Signal Processing Series) 3rd Edition, 2021. p.861, ISBN-13: 978-0131988422, ISBN-10: 0131988425* *Dick Blandford, John Parr. Introduction to Digital Signal Processing. Pearson Education, Inc, 2013, ISBN: 978-0-13-139406-3*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				

Assessment method	Written examination (100 min) and academic performance
Associated study program	B.Sc. Energy & Electrical Engineering B.Sc. Mechatronics Engineering
Prerequisites for participation	Introduction to electrical engineering
Requirements for receiving credit points	Passing the module
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.

EEEL325 – HIGH VOLTAGE ENGINEERING

Module title	High Voltage Engineering			**Module code**	EEEL325
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Syllabus	**Introductory lecture**:Levels of voltages, electrical insulation and dielectrics **Electrostatic fields and field stress control:** Electrical field distribution and breakdown strength of insulating materials - fields in homogeneous, isotropic materials **Electrical breakdown in gases:** Gases as Insulating Media, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges **Conduction and Breakdown in Liquid Dielectrics:** Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids. **Breakdown in Solid Dielectrics:** Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown. **Generation of high voltages:** Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators. **Measurement of High Voltages and Currents:** Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements. **Project:** Power Electronic Applications in High Voltage Grids.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain conduction and breakdown phenomenon in gases, liquid dielectrics. 2. Explain breakdown phenomenon in solid dielectrics. 3. Explain generation of high voltages and currents 4. Discuss measurement techniques for high voltages and currents. 5. Discuss overvoltage phenomenon and insulation coordination in electric power systems. 6. Student get to know modern Power Electronic Applications in High Voltage Grids.				
Literature	*High Voltage Engineering Fundamentals E. Kuffel, W.S. Zaengl, J. Kuffel Newnes 2nd Edition, 2000* *High Voltage Engineering Wadhwa C.L. New Age International 3rd Edition, 2012*				
Form of teaching	Lecture (2 UoI) Laboratory (2 UoI)				
Assessment method	Written examination (120 min) and academic performance				
Associated study program	B.Sc. Energy & Electrical Engineering B.Sc. Mechatronics Engineering				
Prerequisites for participation	Chemistry , Materials 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%.

INTR320 – INDUSTRIAL INTERNSHIP + REFLECTION

Module title	**Industrial Internship + Reflection**			**Module code**	INTR320
Duration	1 semester	**Semester**	Spring	**Module start**	6th
Credit points	10 CP	**Workload**	10 weeks internship	**Contact hours**	
				Individual study	300 h
Syllabus	TBD prior to internship. The Industrial Internship experience provides students with opportunities to explore career interests while applying knowledge and skills learned in the classroom in a work setting. Internship experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to create professional networks.				
Learning outcomes	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 (10 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				
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				

EEEE411 – TRANSMISSION & DISTRIBUTION ENGINEERING

Module title	Transmission & Distribution Engineering			**Module code**	EEEE411
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Syllabus	**Transmission line parameters**: Parameters of single and thre phase transmision lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transpositon **Modelling and performance of transmission lines**: Performance of Transmision lines – short line, medium line, and long line – equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance – transmission efficiency and voltage regulation, real and reactive power flow in lines, steady-state simulation studies. Load flow, steady state simulation studies. Short-circuit, electric systems modelling for permanent regime studies, dynamic regime simulation studies, electric systems modelling for simulation in a dynamic state, transient regime simulation studies, transient regime electric systems modelling. **Mechanical design of lines**: Mechanical design of OH lines – Line Suports –Types of towers – Stres and Sag Calculation – Efects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string eficiency, testing of insulators. **Distribution systems**: Distribution Systems – General Aspects – Kelvin's Law – AC and DC distributions – Techniques of Voltage Control and Power factor improvement – Distribution Los –Types of Substations -Methods of Grounding **Project**: Electrical design of an HV transmission line (Горимын тооцоо).				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the concepts of various methods of generation of power. 2. Design and analyze overhead transmission system for a given voltage level. 3. Calculate the parameters of the transmission line for different configurations and assess the performance of line. 4. Explain the use of underground cables and evaluate different types of distribution systems				
Literature	*A Course in Electrical Power Soni Gupta and Bhatnagar DhanpatRai –* *Principles of Power System V.K. Mehta, Rohit Mehta S. Chand 1st Edition 2013* *S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.* *D.P.Kothari , I.J. Nagarath, 'Power System Engineering', Tata McGraw-Hill* *Colin Bayliss, Brian Hardy: Transmission and Distribution, Electrical Engineering, Newnes, 2011*				
Form of teaching	Lecture (2 UoI) Recitation (4 UoI) Project				
Assessment method	Written examination (100 min.) and academic performance and assesment				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Fundamentals of Electrical Engineering 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%				

EEEL412 – EMBEDDED SYSTEM

Module title	Embedded System			**Module code**	EEEL412
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	• Embedded System Case Studies, Introduction to Embedded Systems • ARM Processor Architecture, ARM Software Development, ARM Instruction Sets, Getting Started with Embedded Software Development (Tools, Packages, Platforms, etc.), Interrupts (ISR, IVT, pitfalls, etc.), Software Architecture (4 types of common architectures), Peripherals (drivers) • Embedded Operating Systems, Real-Time Operating Systems, Java: Concurrency, Pitfalls, and Wireless Applications				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Understand, analyze and explain the basic building blocks of embedded systems hardware 2. Describe the hardware and software architecture of processors used in embedded systems 3. Be able to perform measurements and trouble shootings in digital systems 4. Be able to use embedded system development platforms and environments				
Literature	*Barnett, R. H., O'Cull, L., Cox, S. A. (2007), Embedded C programming and the Atmel AVR. 2 editions. Clifton Park, N.Y.: Thomson Delmar Learning (532 p).* *Floyd, Thomas L. (2009), Digital fundamentals. 10 editions. Upper Saddle River, N.J.: Prentice-Hall (865 p).* *Wolf, Wayne (2008), Computers as components: principles of embedded computing system design. 2 editions. Amsterdam: Elsevier (507 p).*				
Form of teaching	Lecture (2 UoI) Laboratoty (2 UoI) Project				
Assessment method	Written examination (120 min.) and academic performance and project assesment				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Software, Basic Electronics, Measurement, Instrumentation with Microcontroller.				
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%				

EEEE413 – POWER PLANT ENGINEERING

Module title	Power Plant Engineering			**Module code**	EEEE413
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Syllabus	**Classification and Characteristics of fuels and types of power plants incl. nuclear power plants:** Types of fossil fired power plants and nuclear power plants, Characteristics of fuels, Combustion calculation for mongolian Coal and natural Gas **Steam Power Plant:** Plant Layout, Steam cycles (Clausius-Rankine saturated steam cycle and superheated steam cycle), **Combined Heat and Power Plant (CHP):** Advantages of combined electricity and heat generation, Construction and Calculation / Design of CHP power plants with gas or diesel-fired internal combustion engines **Gas turbines and Combined Gas und Steamturbine Cycles:** Gas turbine cycle (Joule-Brayton cycle) and combined cycle (Joule-Brayton/Clausius-Rankine); methods to improve efficiency; thermodynamic calculations of cycles, Plant Layout of the simple/open Gasturbine cycle and arrangements of combined plants (Gas- & Steam turbine power plants) **Components of Steam turbine Cycle:** Firing Systems for solid fuels: Grate furnaces, Pulverized Coal Systems, Fluidized Bed Combustion, Boiler Steam Generators, Basics of heat transfer by convection, radiation and conduction, Determination of the heat transfer coefficients, Construction of heat exchangers in power plants, Turbines and pumps in power plants, Electrical engineering equipment for power generation, transmission and auxiliary power requirement, control technology, Safety and protection systems **Environmental Aspects:** Flue Gas Cleaning Systems like Desulphurization, Denitrification and Decarbonization, Dust Particles Removal **Overview of the Economics of Power Generation:** Load curves, Load duration curves, Connected load, Maximum load, Peak load, Base load and peak load power plants, Load factor, Plant capacity factor, Plant use factor, Demand factor, Diversity factor, Cost of power plant, Performance and operating characteristics of power plant,				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Understand the different power generation methods, based on fossil fuel fired power plants and nuclear power plants 2. Apply the basic thermodynamics and fluid flow principles to different power generation methods 3. Analyze thermodynamic cycles of steam power plant and understand construction, working and significance of its various systems 4. To be able to calculate and design components of steam power plants 5. Analyze thermodynamic cycles of gas turbine power plant, nuclear power plant and combined plants 6. Understand the environmental Aspects of power generation				
Literature	*Power Plant Engineering, P.K. Nag, McGraw-Hill Education* *Power Plant Technology, M.M. El-Wakil, McGraw-Hill Education*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI) Laboratory (2 UoI)				
Assessment method	Written examination (100 min) and academic performance and project assessment				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Engineering Thermodynamics, Hydraulic and Pneumatic Drive				

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%

STWR410 – SCIENTIFIC WRITING

Module title	Scientific Writing			**Module code**	STWR410
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	This module instructs the basics required for the scientific writing and publishing of project works and bachelor theses, and for producing reasonable presentations for conferences, seminars, etc.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Utilize the principles of scientific writing. 2. Competently recapitulate issues. 3. Carry out literature researches. 4. Grasp didactically prepared mediation. 5. Give and assess verbal presentations. 6. Apply moderation techniques.				
Literature	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				

PROJ420 – FINAL STUDY PROJECT

Module title	**Final Study Project**			**Module code**	PROJ420
Duration	1 semester	**Semester**	Fall	**Module start**	7th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Syllabus	Students from different engineering disciplines will work as a team on a current research topic.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Solve a design task with the help of systems engineering. 2. Recognize and specify complex problems occurring in industrial practice. 3. Ascertain and evaluate variants within a team solution. 4. Carry out the main features of an exact time and work schedule team, repeatedly, if necessary. 5. Perform different roles in a team. 6. Represent and assess divergent positions, and develop a problem solution.				
Literature	The literature for this module depends on the project and will be provided be the program coordinators.				
Form of teaching	Project course (2-week interdisciplinary project work, and 1-day field trip), supervised by lecturers of all disciplines involved.				
Assessment 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%)				

EEEE421 - POWER SYSTEM PLANNING, OPERATION AND CONTROL

Module title	Power System Planning, Operation and Control			**Module code**	EEEE421
Duration	1 semester	**Semester**	Spring	**Module start**	8th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Syllabus	Basics of project management Organization of the project management of power plants and other energy supply systems (owner model, general contractor model and full construction project design services) • Planning: concept, draw, detail and practical plan, Long- and short-term planning, load forecasting, advanced methodologies, structure of planning performances (contracts) • Operation: start up and shutdown, load changes, load rating, isolated operation, maintenance of energy supply plants, influence of process parameter on operation and maintenance • Power system security: system monitoring, contingency analysis, security constrained optimal power flow, factors affecting power system security, advanced security monitoring. • Automatic Generation and Voltage Control: Introduction; Load Frequency Control (Single Area Case); Load Frequency Control and Economic Dispatch Control; Two-Area Load Frequency Control; Optimal (Two-Area) Load Frequency Control; Automatic Voltage Control; Load Frequency Control with Generation Rate Constraints (GRCs); Speed Governor Dead-Band and Its Effect on AGC; Digital LF Controllers; Decentralized Control, SCADA and decision-making tools in control centers, advanced controller techniques. Simulation oriented case studies. • Project based on practical power systems				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Be able to prepare and execute a project (eg construction of a wind power plant) 2. Create operating regimes of power plants, develop load profiles 3. Perform reliability and availability analysis, damage analysis 4. Organization of an efficient maintenance regime of power plants				
Literature	*Söder, L., Amelin, M. (2011) Efficient Operation and Planning of Power Systems, Royal Institute of Technology and Electric Power Systems, Stockholm.* *Wood, A.J., Wollenberg, B.F., Sheblé, G.B. (2015) Power Generation, Operation, and Control Third Edition, Wiley.* *Kiameh, OP. (2012) Power Plant Equipment Operation and Maintenance, Mcgraw-Hill Professional.*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI) Project				
Assessment method	Written examination (180 min) and academic performance and project assessment				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Power System Relaying and Protection				
Requirements for receiving credit points	Passing the examinations and project assessment				
Grading system	The final grade consists of the academic performance during the module accounted for 30% and the module examination accounted for 70%				

EEEE422 - POWER SYSTEM RELAYING AND PROTECTION

Module title	Power System Relaying and Protection			**Module code**	EEEE422
Duration	1 semester	**Semester**	Spring	**Module start**	8th
Credit points	6 CP	**Workload**	180 h	**Contact hours**	54 h
				Individual study	126 h
Syllabus	• Introduction to Power System Protection: Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection. • Relay Construction and Operating Principles: Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays. • Overcurrent Protection: Introduction, Time – current Characteristics, Current Setting, Time Setting. • Distance Protection: Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges (Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays. • Pilot Relaying Schemes: Introduction, Wire Pilot Protection, Carrier Current Protection • Differential Protection: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection. • Rotating Machines Protection: Introduction, Protection of Generators. • Transformer and Buszone Protection: Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection. • Circuit Breakers: Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF6 Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers. • Fuses: Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination • Protection against Overvoltages: Causes of Overvoltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydonograph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL). • Modern Trends in Power System Protection: Introduction, gas insulated substation/switchgear (GIS).				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Discuss performance of protective relays, components of protection scheme and relay terminology overcurrent protection. 2. Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays. 3. Discuss pilot protection; wire pilot relaying and carrier pilot relaying. 4. Discuss construction, operating principles and performance of differential relays for differential protection. 5. Discuss protection of generators, motors, Transformer and Bus Zone Protection. 6. Explain the principle of circuit interruption in different types of circuit breakers. 7. Describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse. 8. Discuss protection against Overvoltage and Gas Insulated Substation (GIS). 9. Project for designing power system protection				
Literature	*Power System Protection and Switchgear Badri Ram, D.N. Vishwakarma McGraw Hill 2 nd Edition*				

	Power System Protection and Switchgear (For additional study on gapless arrester, Refer to pages 458 to 461) BhuvaneshOza et al McGraw Hill 1 st Edition, 2010 *C. Das: Power System Protective Relaying, CRC Press; 1. Edition 2017* *P.S.R. Murty: Electrical Power Systems, Butterworth-Heinemann 2017*
Form of teaching	Lecture (2 UoI) Recitation (1 UoI) Project Laboratory (1 UoI)
Assessment method	Written examination (x min) and academic performance and project assessment
Associated study program	B.Sc. Energy and Electrical Engineering
Prerequisites for participation	Fundamentals of Electrical Engineering I, Fundamentals of Electrical Engineering II, Transmission and Distribution Engineering
Requirements for receiving credit points	Passing the examinations and project assessment
Grading system	The final grade consists of the academic performance during the module accounted for 30% and the module examination accounted for 70%

THES420 – BACHELOR THESIS + COLLOQUIUM

Module title	**Bachelor Thesis + Colloquium**			**Module code**	THES420
Duration	1 semester	**Semester**	Spring	**Module start**	8th
Credit points	12 CP	**Workload**	360 h	**Contact hours**	
				Individual study	360 h
Syllabus	Current research topics from the general research area of the administering institute.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Solve scientific questions in a structured manner using engineering science methods. 2. Critically differentiate between various solutions. 3. Present their results in written and oral form in a scientifically acceptable manner.				
Literature	Depends on topic				
Form of teaching	Thesis supervision				
Assessment 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 180 credit points must have been earned.				
Requirements for receiving credit points	Passing the thesis and the presentation				
Grading system	The final grade for the Bachelor thesis consists of the grade of the thesis and of the grade of the performance in the colloquium with a weighting of 4:1 provided that the thesis grade was rated at least as “passed”.				

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**	36 h
				Individual study	54 h
Syllabus	Interdisciplinary summer school with reference to GMIT's profile consisting of lab work, excursions, field trips, and lectures. The following topics will be covered: • Engineering, especially in the context of the resource industry • Environmental aspects of industrial activities • Mining & industry in Germany • Geology • Intercultural competence & self-organization • Higher education institutions and student life abroad The Summer school is accompanied by social events that enforce intercultural contacts.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the general function of industrial or scientific processes covered and the interaction of different processes with another. 2. Identify different materials and their properties and explain their uses in the industrial processes observed. 3. Explain the difference between open pit and underground mining and of the difference technology in use. 4. Describe impacts on the environment and health along the added value chain of natural resources. 5. Perform different activities which are part of mining engineering, such as loading, drilling etc. 6. Identify minerals and rocks and explain their properties 7. Identify different periods in German history, to compare with Mongolian history and to evaluate the impact of historical developments on the present 8. Apply presentation skills				
Literature	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**	36 h
				Individual study	54 h
Syllabus	Interdisciplinary summer school consisting of lectures, recitations, lab works, excursions and intercultural activities. The following topics will be covered: • Introduction to mining safety engineering • Mining & industry in China • Geology • Culture and language • Modern coal mining technology The Summer school is accompanied by social events that enforce intercultural contacts.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Recognize the work process in the mining area and its social and technical aspect. 2. Assess career prospects in the business. 3. Explain the general function of industrial or scientific processes covered and the interaction of different processes with another. 4. Identify different materials and their properties and explain their uses in the industrial processes observed. 5. Explain underground mining and of the difference technology in use. 6. Describe impacts on the environment and health along the added value chain of natural resources. 7. Identify different periods in Chinese history, to compare with Mongolian history and to evaluate the impact of historical developments on the present. 8. Apply skills in writing of reports and essays.				
Literature	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				

LNST150 – LEARNING STRATEGIES

Module title	Learning Strategies			**Module code**	LNST150
Duration	1 semester	**Semester**	Fall	**Module start**	1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	The module aims at helping students to become motivated and strategic learners who effectively use learning strategies to enhance their learning and academic success. Participants will explore and practice various learning strategies and find out more about themselves as learners. The module includes the following topics: • Motivation • Self-organization (time management, learning conditions, concentration) • Learning styles • Collecting and organizing information • Memorizing • Cooperative learning • Stress management and relaxation techniques • Exam preparation and test taking				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Identify their strengths and weaknesses as learners and the obstacles to effective learning. 2. Describe different learning styles and identify their own. 3. Explain various learning techniques. 4. Apply these learning techniques effectively to their own learning process. 5. Understand the factors behind motivation and determine what motivates them. 6. Set goals and monitor their learning progress. 7. Monitor and regulate their time management and organization. 8. Prepare for exams purposefully and effectively. 9. Apply stress management techniques in order to diminish and handle exam anxiety.				
Literature	*Dembo, M.H. (2004) Motivation and Learning Strategies for College Success. A Self-Management Approach, Lawrence Erlbaum Associates.* *Henne, G. (2014) General Skills I: Learning Techniques, Time- and Self-Management.*				
Form of teaching	Lecture (2 UoI)				
Assessment method	Assignments and in-class participation				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronics Engineering				
Prerequisites for participation	C1 English level				
Requirements for receiving credit points	Passing the module				
Grading system	Pass/Fail				

ENVH150 – ENVIRONMENTAL HEALTH

Module title	Learning Strategies			**Module code**	LNST150
Duration	1 semester	**Semester**	Fall	**Module start**	1st
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	This course provides a broad overview of human health and diseases caused by the environmental chemicals and toxins as well as pollution caused by human exploitation of nature, especially by the mining industry. Students are introduced to human diseases by contaminants, pathogens and toxins to realize the seriousness of the environmental diseases and the importance of remediation by environmental engineering. Students will be exposed to basic concepts of pathology, toxicology, occupational health and industrial hygiene, and consumer health and safety. Topics include contaminants, pathogens and toxins that cause human diseases; pathology of the diseases; symptoms and signs of the diseases; possible treatments and prognoses; and possible approaches to prevent the environmental health problems. • Describe environmental risk factors that affect both personal and population health. • Identify organic and inorganic compounds, and how they influence population health. • Gain knowledge and understanding of the pathology of the environmental diseases. • Understand the symptoms and signs of environmental diseases as well as possible diagnostic measures and treatments. • Discuss the possible prevention methods using the pathology knowledge on environmental diseases.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Gain a general understanding of human health and disease. 2. Recognize major contaminants, pathogens and toxins causing human diseases. 3. Understand how some organic and inorganic compounds become toxic inside of the human body. 4. Identify and examine the cause of environmental diseases. 5. Formulate possible treatments for these diseases. 6. Outline the basic types of environmental remediation and the importance in terms of improving human health. 7. Describe how to avoid environmental diseases. 8. Develop possible prevention methods. 9. Apply their knowledge gained in the course to the specific situation in Mongolia, especially with regard to the influence of the mining industry on the environment.				
Literature	*Frumkin, H. Environmental Health: From Global to Local, 3rd Edition (2016). New Jersey, USA. Wiley*				
Form of teaching	Recitation (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	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%.				

EEEE431 – SMART GRID*

Module title	Smart Grid			**Module code**	EEEE431
Duration	1 semester	**Semester**	Fall	**Module start**	6th, 7th, 8th
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	• Overview and basics of power grid systems, electric power transfer concepts, governing theories • Electric power transmission and distribution systems • Distributed generation/Grid integration of renewable energy source • Smart power grid concepts in general/ Components and main equipment • System operation and management of future power grids, active network operation (Role of information technology, demand side management, microgrids, super grids and universal grids) • Connection of electromobility to smart grids • Virtual power plants for economic and network optimization • Communication infrastructures for smart grids (Smart metering infrastructures, privacy and security in smart grids, information models)				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Recall main concepts: transmission systems, distribution systems, microgrids, grid integrations and smart grids. 2. Define the operating behavior of the power transmission and distribution systems 3. Calculate power and voltage losses of high voltage transmission lines 4. Calculate power consumptions of power distribution systems 5. Apply knowledge in major courses and practical issues 6. Solve problems related to power grids by using MATLAB.				
Literature	*Electric Power Transmission and Distribution, by S. Satyanarayana, S. Sivanagaraju, July 2008* *Smart Power Grids 2011, Editors: Keyhani, Ali, Marwali, Muhammad (Eds.), 2012.*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (x min) and academic performance				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Transmission and Distribution 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%				

EEEE432 – ENERGY SYSTEM DESIGN (MODELLING AND ANALYSIS)*

Module title	Energy System Design (Modelling and Analysis)			**Module code**	EEEE432
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	6th, 7th, 8th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	Dynamic state of electrical power systems. Methods and models for analysis of the dynamics, stability and control of an electric power system. The electricity market. Connection of intermittent (renewable) sources to the grid. Voltage, frequency and small signal stability. Accessibility and vulnerability				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Critically analyse the power system and the grid structure from an overall perspective, including vulnerability, 2. Perform calculations on connected complex electrical power networks with multiple sources and loads in terms of stability, losses and load flows under stationary conditions 3. Account for connection of distributed and new renewable sources to the grid, 4. Perform error analysis for both symmetric and unsymmetric conditions, 5. Account for different regulatory principles, compensation principles and equipment, 6. Explain dynamic states and instability in power systems, 7. Use mathematical models for analysis of dynamic events and stability, 8. Analyze the impact of various technical solutions for damping network drifts and stabilization				
Literature	*Glover, J. Duncan; Sarma, Mulukutla S.; Overbye, Thomas J.Power system analysis and design, 4. ed.: Toronto, Ontario: Thomson Learning, cop. 2008* *Schavemaker, Pieter; Van der Sluis, Lou, Electrical power system essentials, Hoboken, N.J.: Wiley, cop. 2008*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (180 min) and academic performance				
Associated study program	B.Sc. Electrical Power Engineering				
Prerequisites for participation	Renewable Energy Systems				
Requirements for receiving credit points	Passing the examinations and project assessment				
Grading system	The final grade consists of the academic performance during the module accounted for 30% and the module examination accounted for 70%				

EEEE433 – ENERGY ECONOMY AND PLANNING*

Module title	Energy Economy and Planning			**Module code**	EEEE433
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	6th
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	• Introduction (Philosophical and Evolutionary Aspects of Energy, Why Energy Economics, History of Energy Economics, Energy Input-Output Analysis)Investment and Profitability Calculation (Interest Rate and Price of Capital, Inflation-Adjusted Interest Rate, Social Time Preference, Interest Rate and Risk, Real Option Valuation) • Bottom-Up Analysis of Energy Demand (Process Analysis, Stock of Appliances, Buildings, Vehicles, and Machineries) • Top-Down Analysis of Energy Demand (Population Growth, Economic Growth, The Price of Energy, Technological Change) • Energy Reserves and Sustainability (Resources and Reserves, Resources and Reserves, Optimal Resource Extraction: Social Welfare View, Sustainability) • External Costs (The Coase Theorem, Aggregate Emissions, Instruments of Environmental Policy) • Survey of the economics of various resource and energy markets, both in the Mongolia and globally (including Russia and China) • Traditional economic models and their application to relevant energy markets • Major issues and trends associated with global and local energy markets • Economic growth and development, and regulations				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Use economic tools to describe the production and consumption of energy. 2. Be able to apply economic models of competition to energy markets. 3. Apply the tools of economics to assess contemporary issues in energy economics and 4. policy. 5. Be able to articulate how energy contributes to the climate change discussion and articulate an opinion on the determinants of climate change policy. 6. Demonstrate writing and research dissemination skills through work on group projects and class presentations.Explain dynamic states and instability in power systems, 7. Use mathematical models for analysis of dynamic events and stability, 8. Analyze the impact of various technical solutions for damping network drifts and stabilization				
Literature	*Peter Zweifel, Aaron Praktiknjo, Georg Erdmann, "Energy Economics: Theory and Applications" Springer Texts in Business and Economics, ISSN 2192-4333*				
Form of teaching	Lecture (2 UoI)				
Assessment method	Written examination (x min) and academic performance				
Associated study program	B.Sc. Electrical Power Engineering				
Prerequisites for participation	Fundamentals of Electrical Engineering I, Fundamentals of Electrical Engineering II, Transmission and Distribution Engineering				
Requirements for receiving credit points	Passing the examinations and project assessment				
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.				

EEEN434 – HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

Module title	High Voltage Direct Current Transmission			**Module code**	EEEN434
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	6th, 7th, 8th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	Evolution of HVDC systems, comparison of HVAC and HVDC transmission systems, components of HVDC transmission system, analysis of HVDC converters, HVDC control, mal-operation and protection of converters, filter design, AC/DC load flow and stability analysis, multi-terminal HVDC, different application of HVDC system, advances in HVDC systems.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. To analyse HVDC converters, harmonics and design of filters. 2. To learn about HVDC cables and simulation tools. 3. Analyse the transmission line models and evaluate its performance parameters. 4. Design the transmission lines under various working conditions. 5. Describe and select the configurations of different line insulators and evaluate their performance. 6. Supervise the laying of cables and fault detection in cables. 7. Design the distribution system network				
Literature	*Padiyar, K. R., "HVDC power transmission system", Wiley Eastern Limited, New Delhi Third Edition. 2015.* *S. Rao, "EHV-AC, HVDC Transmission and Distribution Engineering", Third Edition. 2013.*				
Form of teaching	Lecture (2 UoI) Recitation (2 UoI)				
Assessment method	Written examination (90 min) and academic performance				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Passing the modules Introduction to Computer Science and Programming				
Requirements for receiving credit points	Passing the examinations and project assessment				
Grading system	The final grade consists of the academic performance during the module accounted for 30% and the module examination accounted for 70%				

EEEL435 – ENERGY MANAGEMENT SYSTEMS AND AUDITING

Module title	Energy Management Systems and Auditing			**Module code**	EEEL435
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	6th, 7th, 8th
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	**Introduction:** Energy resources; Environment, climate change and sustainability. **Energy management:** Energy management in organizations; Energy efficiency and energy conservation; Environmental impacts, including greenhouse gas emissions, of Energy; Legal and other requirements applicable to the energy management. **Energy monitoring, measurement and analysis:** Energy performance indicators; Energy monitoring devices and instruments; Energy monitoring, measurement and analysis. **Energy analysis**: Energy review; Development of energy baseline and energy plans. **Energy management systems:** Management systems approach for energy management in organizations; Energy management systems and requirements of ISO 50001; Development, implementation, maintenance and improvement of energy management systems. **Auditing and certification of energy management systems:** ISO 19011 and internal and second party auditing of energy management systems; ISO 17021 and third party auditing and management system certification/registration. **Case study:** Energy management system auditing case study				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Knows the energy management systems and their essential elements 2. Able to develop, implement and maintain Energy Management Systems in organizations 3. Able to carry out Energy Management Systems Auditing 4. Able to carry out energy analysis of organizations and development of energy baseline				
Literature	*ISO 19011: 2011- Guidelines for auditing management systems.* *ISO 17021: 2011 - Conformity assessment — Requirements for bodies providing audit and certification of management systems.* *ISO 50001: 2011 - Energy management systems — Requirements with guidance for use.* *Thumann and W.J. Younger: Handbook of energy audits, Fairmont Press, Georgia, USA (2003).* *Bureau of energy efficiency, New Delhi, India: Guide Book - National certificate examination for energy management and energy audit, 2005 (Book I - General aspect of energy management and energy audit; Book II* *Energy efficiency in thermal utilities; Book III - Energy efficiency in electrical utilities; and Book IV - Energy performance assessment for equipment & utility systems)*				
Form of teaching	Lecture (2 UoI)				
Assessment method	Written examination (90 min) and academic performance				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Passing the modules Introduction to Computer Science and Programming				
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%				

EEEL436 – POWER QUALITY

Module title	Power Quality			**Module code**	EEEL436
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	6th, 7th, 8th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	**Introduction to Power Quality:** Definition of power Quality, power quality terminology, power quality issues, Susceptibility Criteria, Responsibility of supplier and users of elect power, Standards **Power Frequency Disturbance:** Common power frequency disturbances, voltage sags, cures of low frequency disturbances, voltage tolerance **Electrical Transients:** Transient system model, Examples of models & response, Types and causes of transients, Examples of transient wave forms **Harmonics:** Definition , number, odd and even harmonics, causes of harmonics, Individual & total distortion, Harmonics signatures, Effect of harmonics, Guide lines for harmonic voltage & current limitation, Harmonic current mitigation **Grounding & Bonding:** Introduction, National electric code grounding requirements, Essentials of grounding system, Ground electrodes, Earth resistance tests, Earth ground grid system, Power Ground system, Signal reference ground, Signal reference ground methods, Single and multi-point grounding, Ground loops **Power Factor:** Introduction, Active and Reactive power, Displacement and true power factor, power factor improvement, correction, penalty, voltage rise due to capacitance, application of synchronous condensers and static VAR compensators **Electromagnetic Interference:** Electric and magnetic fields, Electromagnetic interference terminology, Power frequency fields, High frequency interference, EMI Mitigation, Cable shielding to minimize EMI, Health concerns of EMI **Power Quality Measurement:** Power quality measurement devices, power quality measurements, Number of test locations, Test duration, Instrument set-up, Instrument set up guidelines. **Distributed Generation and Power Quality:** Resurgence of DG, DG technologies, Interface to the utility system, Power quality issues, Operating conflicts,				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Understand the major power quality problems. 2. Use equipment that are required to measure the quality of power 3. Apply and analyse/compare techniques available to mitigate power quality problems				
Literature	*Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.WayneBeaty, Electrical Power Systems Quality, McGraw Hill,2003* *J. Arrillaga, N.R. Watson, S. Chen, Power System Quality Assessment, (New York : Wiley),2000.* *Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, Power Quality Problems and Mitigation Techniques Wiley, 2015*				
Form of teaching	Lecture (2 UoI) Laboratory (2 UoI)				
Assessment method	Written examination (90 min) and academic performance				
Associated study program	B.Sc. Energy and Electrical Engineering				
Prerequisites for participation	Passing the modules Introduction to Computer Science and Programming				
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%				

EEEM431 – SOFTWARE ENGINEERING*

Module title	Software Engineering			**Module code**	EEEM431
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	6th, 7th, 8th
Credit points	4 CP	**Workload**	120 h	**Contact hours**	36 h
				Individual study	84 h
Syllabus	This course comprises the following topics: • Software development process • V-Development Process • Design Patterns • Verification methods • Software version management • Project: Practical Applications				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Explain the steps in a software development process 2. Apply the Unified Modeling Language (UML) 3. Create design patterns in software engineering 4. Apply and assess the verification of software 5. Perform software version management				
Literature	*Abran, Alain; Moore, James W.; Bourque, Pierre; Dupuis, Robert; Tripp, Leonard L. (2004). Guide to the Software Engineering Body of Knowledge. IEEE* *Sommerville, Ian (2008). Software Engineering (7 ed.). Pearson Education.* *Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides (2007). Design Patterns: Elements of Reusable Object-Oriented Software (34 ed.). Addison-Wesely* *Bruegge, Bernd; Dutoit, Allen (2009). Object-oriented software engineering: using UML, patterns, and Java (3rd ed.). Prentice Hall*				
Form of teaching	Lecture (2 UoI) Laboratory (2 UoI)				
Assessment method	Written examination (90 min) and academic performance				
Associated study program	B.Sc. Mechatronics Engineering B.Sc. Electrical Power Engineering				
Prerequisites for participation	Passing the modules Introduction to Computer Science and Programming				
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**	336 h	**Contact hours**	224 h
				Individual study	112 h
Syllabus	**Grammar Syllabus:** Gerund/ infinitive, the present and stative verbs, used to and would, passive, causative, future, conditionals and wishes, inversion, modal verbs, relatives, indirect speech and reporting verbs, articles and punctuation **Vocabulary and Topical Syllabus:** Ambition, career success, pastimes and hobbies, family, media, social problems, technology, science jobs, health problems, school, college, university, advertising, communication				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Express themselves clearly and talk about complex facts in a structured and detailed way. 2. Use language efficiently and flexibly in their social and professional lives as well as in their studies. 3. Write correctly to a large degree on a number of complex topics. 4. understand almost all kinds of spoken language, live or broadcast, at a fast-native speed. 5. Read with ease abstract, structurally or linguistically complex texts. 6. Summarize correctly and concisely written texts and oral presentations in their own words. 7. Deliver a presentation using a clear organized structure, helpful slides, and signposting. 8. Express their opinion as well as disagreement and agreement in a tactful way. 9. Describe data, graphs and statistics using appropriate structures. Integrate their reading, writing, and speaking skills to promote creative thinking and independent learning				
Literature	*Virginia Evans-Jenny Dooley, Lynda Edwards, Upstream Advanced C1, Express Publishing 2005* *Virginia Evans, Lynda Edwards, Jenny Dooley, Upstream Advanced C1, Workbook, Express Publishing 2005*				
Form of teaching	Recitation (14 UoI in BEP, 8 UoI in 1st Semester in B.Sc. Programs)				
Assessment method	Short presentations, in-class assignments, quizzes, written and oral examination				
Associated study program	BEP / 1st Semester of Bachelor programs				
Prerequisites for participation	Participants must have successfully completed level B2 or have a comparable knowledge of English				
Requirements for receiving credit points	Written examination (90 min), in-class oral examination and academic performance.				
Grading system	The modes of assessment total 100%.				

ENGL150 – BUSINESS ENGLISH FOR THE WORKPLACE

Module title	Business English for the Workplace			**Module code**	ENGL150
Duration	1 semester	**Semester**	Fall	**Module start**	All
Credit points	3 CP	**Workload**	90 h	**Contact hours**	36 h
				Individual study	54 h
Syllabus	Participants in this course learn • Useful and authentic English for the workplace, including vocabulary and common phrases • How to write various types of e-mails and business letters and to respect norms and conventions • How to conduct meetings and negotiations in English • How to conduct telephone conversations in English • How to make small talk and to socialize in professional settings • How to deliver a business presentation • The fundamentals of applying for a job in English, e.g. cover letter and résumé business etiquette and how to achieve the right tone in different professional situations				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Participate in a variety of professional situations with greater ease and in an appropriate manner. 2. Write various types of e-mails and business letters. 3. Identify and apply vocabulary, morpho-syntactic structures and stylistic forms typical of business communication. 4. Conduct meetings, negotiations and telephone conversations. 5. Socialize in professional settings with greater ease. 6. Deliver a business presentation using the appropriate signposts. 7. Apply for a job in English. 8. Understand the role culture plays in business interactions. 9. Compare and contrast their cultural underpinnings with those in other cultures, especially with regard to business interactions. 10. Respond in an intercultural sensitive manner to conflict in business settings				
Literature	*Emmerson, P. (2013). Email English, 2nd Edition, Macmillan.* *Hughes, J. (2006). Telephone English, Macmillan.* *Stephens, B. (2011). Meetings in English, Macmillan*				
Form of teaching	Student-centered language course (4UoI)				
Assessment method	Presentation, e-mails, mock meeting/negotiation, final exam				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronics Engineering				
Prerequisites for participation	C1 level of English				
Requirements for receiving credit points	Passing the module				
Grading system	The final grade consists of the academic performance during the module accounting for 30% and the module examination accounting for 70%.				

MNGL150 – MONGOLIAN STYLISTICS

Module title	Mongolian Stylistics			**Module code**	MNGL150
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	1st, 2nd, 3rd, 4th,
Credit points	2 CP	**Workload**	60 h	**Contact hours**	24 h
				Individual study	36 h
Syllabus	Participants will read texts of different genres, discuss text comprehension and analyze how the texts are structured and which stylistic means, grammatical structures and vocabulary are used. Grammar and spelling rules will be revised. Participants will practice text analyses, summaries and, furthermore, apply their knowledge of style, academic vocabulary and grammar to their own text production. Participants will also learn how to express their thoughts in oral speech, e.g. in discussions and presentations.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Comprehend and analyze texts of different genres and recognize their specific characteristics, 2. Write text summaries, 3. Structure their thoughts in a text 4. Write a formal letter, an application and other short texts as well as an essay with correct grammar, spelling and using appropriate stylistic means 5. Give an academic presentation using appropriate language				
Literature	*„Монгол хэлний найруулга зүй", Ц. Сүхбаатар, УБ., 2007* *„Орчин цагийн монгол хэлний найруулга зүйн дасгал"С. Мөнхцэцэг, УБ., 2016* *„Монгол хэлний найруулга зүй"Ц. Оюунбат, С. Мөнхцэцэг, УБ., 2012* *"Монгол хэлний хураангуй тайлбар толь", Мон судар, 2009*				
Form of teaching	Recitation (2 UoI)				
Assessment 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. Mechatronics Engineering				
Prerequisites for participation	C1 level of English and successful completion of Academic Writing I				
Requirements for receiving credit points	At least 70% of the course grade will be based on evaluation of the formal writing. Formal research writing assignments are required				
Grading system	Preliminary Research Portfolio: 20% Critical Presentation: 30% Final Portfolio: 50%				

ENGL150 – ACADEMIC WRITING I

Module title	Academic writing			**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**	36 h
				Individual study	54 h
Syllabus	The goal of this module is to offer an introduction to formal writing to the undergraduates which is required in their academic studies at the university. The objectives of the module are to familiarize learners with a formal tone, use of the third-person rather than first-person, focus on the topic, precise word choice on the one part, and to introduce them with a paragraph and essay structures, unity and coherence, outlines, first and second drafts and editing on the other part. The goal and objectives will be achieved by offering the below-mentioned syllabus: • Paragraphs • The five-paragraph essay • Unity within a paragraph and within an essay • Coherence • Brainstorming and making outlines • Drafts and editing • Descriptive essays • Formal emails • CV and motivation or cover letters • Process Analysis Essays • Cause and Effect Essays • Argumentative Essays • Opinion Essays • Reports • Lab report discussions • Reviews				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Recognize, understand and recall the structural components of academic writing at paragraph and essay levels. 2. Identify and apply formal register and tone. 3. Analyze and evaluate different types of academic writing, e.g. essays, reviews and reports. 4. Summarize the main points of academic texts in writing. 5. Organize and present arguments in a logical fashion. 6. Apply cohesive devices. 7. Create their own pieces of academic writing. 8. Critically examine and improve upon their own writing. 9. Apply the skills acquired in the module to their further academic studies.				
Literature	*Alice Savage and Patricia Mayer Effective Academic Writing 2, 3* *Jordan, R.R. (2003) Academic Writing Course, Longman.* *Barnet, S. and Stubbs, M. (1995) Practical Guide to Writing, Harper Collins.* *Websites: IELTS Writing Skills, British Council, BBC Learn English Writing skills*				
Form of teaching	Recitation (4 UoI)				
Assessment 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. Mechatronics Engineering				

Prerequisites for participation	C1 English level
Requirements for receiving credit points	Passing the module.
Grading system	Continuous assessment (presentations and essays): Pass or Fail

ENGL152 – ACADEMIC WRITING II

Module title	Academic writing II			**Module code**	ENGL152
Duration	1 semester	**Semester**	Fall and Spring	**Module start**	1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	36 h
				Individual study	54 h
Syllabus	The purpose of this course is to provide participants with the opportunity to improve their skills in writing a research article and other academic texts. This course builds upon the fundamentals that were learned in Introduction to Academic Writing. Students apply what is learned by drafting short academic articles and abstracts related to their area of specialization, all the while critiquing their own writing in an effort to improve their autonomous learning skills.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Understand the interaction between writer, text and reader. 2. Discriminate between academic writing and other forms of writing and English. 3. Identify and select suitable grammatical structures and academic vocabulary for a variety of texts. 4. Formulate and write a research proposal. 5. Effectively record data and experiments so that others can understand them, and so that they can form the basis of a thesis. 6. Communicate science by means of a thesis, written in the format of a scientific journal article. 7. Practice effective, correct and appropriate writing in the students' area of specialization. 8. Examine and critique their own scientific writing in order to improve upon their own writing 9. Provide feedback on another people's writing.				
Literature	*Rowena Murray, Third Edition (2011). How to write a Thesis. Berkshire, England, McGraw Hill Open University Press.* *Laurie Rozakis. (1999). Schaum's Quick Guide to Writing Great Research Papers. NY, U.S.A., McGraw Hill.* *Beverly Ann Chin. (2004). How to Write a Great Research Paper. NJ, U.S.A., John Wiley & Sons, Inc.*				
Form of teaching	Lecture				
Assessment method	A collection of writing that is drafted, revised, and edited during the course is required, including a minimum of 4 extended formal research papers. Rubrics to evaluate student writing will be derived from the outcomes listed above				
Associated study program	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. Mechatronics Engineering				
Prerequisites for participation	C1 English level English successful completion of Academic Writing I				

Requirements for receiving credit points	At least 70% of the course grade will be based on evaluation of the formal writing. Formal research writing assignments are required.
Grading system	Preliminary Research Portfolio: 20% Critical Presentation: 30% Final Portfolio: 50%

HIST150 – WORLD HISTORY

Module title	World History			**Module code**	HIST150
Duration	1 semester	**Semester**	Fall	**Module start**	1st, 3rd, 5th, 7th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	36 h
				Individual study	54 h
Syllabus	This elective survey the history of Western Civilization from the neo-Lithic (new stone age) period through the late Medieval/early Renaissance period. This course focuses on the advance of modernity in human civilization. Students will discuss the trends, scientific developments, and cultural changes in Western Civilization. The focus will be on the exploration and critique of the European civilization because circumstance has granted Western Civilization relative dominance in world affairs.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe how cultural change, economic events, the evolution of religious thought, and technological change have given Europeans their distinctive worldview and contributed to the present-day world system as well as Mongolia's role in it. 2. Define the main characteristics and events in a given historical period. 3. Assess scholarly writings and primary source matter critically. 4. Draw parallels between events and issues across historical periods. 5. Grasp and interpret why and how the Social Sciences contribute significantly to the development of civilization. 6. Draft one short research paper at the undergraduate university level. 7. Examine and edit their own academic writing. 8. Plan, organize and carry out tasks independently.				
Literature	*Duiker, W. J. and Spielvogel, J. J. (2016) World History 8th edition. Spielvogel, J. V. (2008) Glencoe World History, Glencoe-McGraw Hill. Various primary source materials in photocopy*				
Form of teaching	Recitation (4UoI)				
Assessment 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. Mechatronics Engineering				
Prerequisites for participation	C1 English level				
Requirements for receiving credit points	Passing the module				
Grading system	The final grade consists of the academic performance during the module (30%) and the module examination (70%).				

LITF150 – LITERATURE AND FILM

Module title	Literature and Film			**Module code**	LITF150
Duration	1 semester	**Semester**	Fall	**Module start**	1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th
Credit points	3 CP	**Workload**	90 h	**Contact hours**	36 h
				Individual study	54 h
Syllabus	This module surveys the art of literature and film and the role they play in our lives. Selected pieces of literature and the film versions based on them are analyzed as unique pieces of art using different techniques to tell stories. In addition to that, the possibilities, challenges and results of the transposition of literature to film are investigated.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Describe and appreciate works of literature written in English. 2. Analyze works of fiction for plot structure, and setting. characterization, theme, and narrative point of view. 3. Explain how the story is constructed and the message created. 4. Critically examine film adaptations of literary texts along similar techniques but also including the techniques specific to the cinema (e.g. sound, special effects, lighting, cut, dialogue). 5. Write literature and film reviews appropriately utilizing the terminology of literature and film analysis. 6. Express their opinions on the pieces of art using appropriate academic vocabulary. 7. Reflect on the potential and limitations of turning literary texts into film and the impact it has on the story and the message. 8. Compare and contrast films based on literature with blockbuster films not adapted from literature. 9. Distinguish how different media influence our lives, and how they can impact emotions or may direct behavior.				
Literature	*Corrigan T. (2018) Film and Literature: An Introduction and Reader, 2nd Edition Routledge*				
Form of teaching	Recitation (4UoI)				
Assessment method	Academic performance in class (contribution to discussion, short literature and film reviews, project/presentation) and final research paper				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronics 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%).				

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**	36 h
				Individual study	54 h
Syllabus	Basic knowledge and skills in pronunciation, spelling (alphabet), intonation (word and sentence stress) of the German language. Main topics are first contact, classroom language, languages/ countries/ sights, jobs, living, time, numbers, making appointments, how to find the way in the city and in buildings, means of transport. Grammar problems, e.g. sentence structure (statements and questions), present tense of verbs, past tense of “haben” and “sein”, negation, articles, possessive pronoun, use of prepositions (place/time), cardinal numbers, dative and accusative cases, are introduced and practiced. Basic information about German geography and culture is introduced.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Know the basic principles of pronunciation, intonation, spelling of German. 2. Construct grammatically and semantically correct sentences, produce simple statements and questions in oral communication as well as in writing. 3. Introduce themselves and others and make themselves understood in the classroom. 4. Talk about the geographical location of places and say where people work/study and ask for the way. 5. Describe houses/apartments. 6. Tell the time and make appointments. 7. Apply integrated learning strategies to improve upon their learning independently.				
Literature	*Corrigan T. (2018) Film and Literature: An Introduction and Reader, 2nd Edition Routledge*				
Form of teaching	Recitation (4UoI)				
Assessment method	Academic performance in class (contribution to discussion, short literature and film reviews, project/presentation) and final research paper				
Associated study program	B.Sc. Mechanical Engineering B.Sc. Raw Materials and Process Engineering B.Sc. Environmental Engineering B.Sc. Industrial Engineering B.Sc. Energy and Electrical Engineering B.Sc. Mechatronics 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**	36 h
				Individual study	54 h
Syllabus	Basic knowledge and skills in pronunciation, spelling, grammar, and vocabulary of the German language as well as basic aspects of German culture. The main topics include: food/shopping, professions, daily routine/everyday life, holidays, seasons/weather, fashion, the human body/health. Grammar points include: modal verbs, perfect tense, comparison, adjectives, imperative and personal pronouns. In this module A1 (beginner) level is completed.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Pronounce and spell German words and intone sentences correctly. 2. Construct grammatically and semantically correct sentences and make simple statements in oral communication as well as in writing. 3. Understand simple everyday conversation and short and simple oral material. 4. Talk about professions, clothes, the weather, the human body, feelings, food, holidays and daily routines. 5. Give recommendations and write simple letters. 6. Understand weather forecasts, recipes and various other short texts of different genres. 7. Provide basic facts about Germany and German culture. 8. Apply integrated learning strategies to improve upon their learning independently.				
Literature	*Funk/Kuhn.Studio 21. Das Deutschbuch. A1.2, Cornelsen,2013.*				
Form of teaching	Recitation (4UoI)				
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. Mechatronics 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**	36 h
				Individual study	54 h
Syllabus	This module will pursue further work to improve students' skills in pronunciation and spelling as well as grammar and vocabulary. Language tasks will include: talking about one's self and one's family, describing people and pictures, extending invitations and congratulating people, expressing one's opinion, talking about trips and one's hobbies, describing one's emotions, discussing advertisements and the media, ordering food in a restaurant and explaining one's leisure time activities The grammar points covered in this module include subordinate clauses with *weil, dass*, and *ob* comparative and superlative adjectives, possessive article and adjectives in the dative case, the genitive /s/, main clauses with *aber* and *oder* , the modal verb sollen, reflexive pronouns, adverbs of time, verbs with prepositions, indefinite pronouns, personal pronouns in the dative case. Further understanding of aspects of German culture				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Apply their knowledge of German pronunciation, intonation and spelling to new words and sentences. 2. Construct grammatically and semantically correct sentences at a basic level. 3. Use proper vocabulary to discuss topics such as family, biography, languages, travelling, leisure and media. 4. Produce written texts that go beyond the sentence level. 5. Interact successfully and appropriately in everyday oral communication. 6. Understand short oral texts. 7. Grasp the meaning of various short written texts. 8. Describe in more detail many aspects of German culture (e.g. migration, literature, geography). 9. Apply integrated learning strategies to improve upon their learning independently				
Literature	*Funk/Kuhn. Studio 21. Das Deutschbuch. A2.1, CornelsenVerlag, 2015.*				
Form of teaching	Recitation (4 UoI)				
Assessment 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. Mechatronics 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**	36 h
				Individual study	54 h
Syllabus	This module will pursue further work to improve students' skills in pronunciation and spelling as well as grammar and vocabulary. The language tasks of this module include: talking about moving from the countryside to the city; discussing various forms of culture, applying for a job and describing one's future career plans; celebrations and holidays; emotions and films; innovative ideas and inventions The grammar points covered in this module include: modal verbs in the past, adverbs of time, comparison of the preterite and perfect verb tenses, subordinate clauses with *wenn, als um…zu* and *damit*, the verb *werden*, nominalization, polite requests, prepositions and verbs with the dative case, verbs with accusative complements, genitive case, relative clauses with in and mit, *werden/wurden*. Acquisition of additional aspects of German culture. Completion of level A2 (elementary).				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Correctly apply their knowledge in the pronunciation, intonation and spelling of German to new words and sentences. 2. Construct grammatically complex and semantically correct sentences. 3. Use proper vocabulary to discuss topics such as culture and arts, the workplace and professions, celebrations and holidays, country and city life and inventions and technology. 4. Produce more complex written text. 5. Interact effectively and appropriately in everyday speaking situations. 6. Understand various types of short written texts. 7. Grasp the core meaning of a variety of audio and video material of intermediate difficulty. 8. Provide basic facts about German culture, geography and society. 9. Apply integrated learning strategies to improve upon their learning independently				
Literature	*Funk/Kuhn. (2015) Studio 21. Das Deutschbuch. A2.2, Cornelsen.*				
Form of teaching	Recitation (4 UoI)				
Assessment 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. Mechatronics 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**	36 h
				Individual study	54 h
Syllabus	Development and application of the knowledge and skills acquired in the A1 and A2 levels. Additional topics include: German/European history, men/women, aspects of professional life and the education system. Grammar points include: subordinated sentences, past tense of irregular verbs, word formation and conditional forms.				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Interact adequately in most situations of everyday life. 2. Speak in a simple but well-structured way about topics like politics, history, and culture. 3. Give recommendations; agree or disagree; express their opinion and give reasons. 4. Describe dreams, wishes and goals; and report about experiences and events. 5. Read and understand short newspaper articles. 6. Write texts on a number of everyday topics that consist of several paragraphs and employ cohesive structures to organize the text as a whole. 7. Deliver short presentations on a number of topics related to everyday life, history and culture. 8. Understand everyday conversations as well as audio and video material of intermediate difficulty. 9. Apply integrated learning strategies to improve upon their learning independently.				
Literature	*Funk/Kuhn/Winzer-Kiontke. Studio 21. Das Deutschbuch. B1.1, Cornelsen Verlag, 2015*				
Form of teaching	Recitation (4 UoI)				
Assessment 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. Mechatronics 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**	36 h
				Individual study	54 h
Syllabus	Development and application of the knowledge and skills acquired in the A1 and A2 levels. Additional topics include: climate/environment, conflicts, generations and age, migration and (European) politics. Grammar points include: future and past perfect tense, genitive case, conjunctions and subordinated sentences, word formation and phrasal verbs. Completion of level B1 (intermediate).				
Learning outcomes	On successful completion of this module, the students should be able to: 1. Interact adequately and appropriately in all situations of everyday life. 2. Speak and write in a simple but well-structured way about topics like climate change and the environment, politics, history and culture. 3. Express their opinion and give reasons as well as provide arguments. 4. Talk about advantages and disadvantages, give alternatives, comment on various topics of intermediate difficulty. 5. Express their problems, fears and hopes both orally and in writing. 6. Understand and write basic literary texts. 7. Grasp the meaning of a variety of discursive texts of intermediate difficulty. 8. Understand conversations as well as authentic audio and video material on a number of topics of intermediate difficulty. 9. Give presentations. 10. Apply integrated learning strategies to improve upon their learning independently.				
Literature	*Funk/Kuhn/Winzer-Kiontke. Studio 21. Das Deutschbuch. B1.2, Cornelsen Verlag,2015(tests and homework assignments).*				
Form of teaching	Recitation (4 UoI)				
Assessment 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. Mechatronics 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%.				

REVISION TABLE FOR NEW MODULE HANDBOOK