Course Description		
Course title:	Material testing	
Neptun code:	MAKPOL227B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Prof. Dr. György CZÉL	
Contact of lecturer:	gyorgy.czel@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	1/autumn	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is to teach material testing of metallic and non-metallic materials. Another goal is to determine the mechanical properties and material characteristics of various materials using mechanical methods, so that the student himself performs the measurements and evaluates the measurements. The student participating in the training prepares the measurement reports himself, so mastering the editing of technical documents can also be displayed as an intermediate goal.	
Course structure:	**Week**	**Topic**
	1.	Purpose of material testing
	2.	Coexistence of elastic load and deformation
	3.	The historicity of the concept of hardness
	4.	Tensile testing of metals (tensile test)
	5.	Derivative determined by tear test material properties
	6.	Tensile testing of polymers
	7.	Fracture mechanics tests
	8.	Fatiguing tests
	9.	Technological tests, Material categories for fracture according to behavior
	10.	Non-destructive tests
	11.	Ultrasound examinations
	12.	Industrial practice of material testing
	13.	
Required readings:	William D. Callister,Jr.: Fundamentals of Materials Science and Engineering (ISBN: 0-471-47014-7)	
Recommended readings:	Berg, McGarry, Elliot: Composite materials testing and design (anerican Society for testing Materials, 1974)	
Evaluation method:	midterm test and 10 reports	
Evaluation method:		

Course Description	
Course title:	Basics of Physics
Neptun code:	GEFIT051B
Type (core, specialization, optional, dissertation, other):	core

Lecture/ Seminar (practical); hours per week:	2p	
Name and position of lecturer:	Dr. Gábor Pszota, associate professor	
Contact of lecturer:	gabor.pszota@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	1/autumn	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	practial mark	
Course objectives (50-100 words):	Getting to know the most important basic concepts of Physics, repeating what you learned in high school. In the classes, we mainly deal with the concepts of Mechanics, and we perform tasks related to the mechanics of the point of mass and simple systems. A prominent role is given to measurements and mathematics clarifying the relationships between methods and model creation, as well as showing solutions to tasks from multiple perspectives.	
Course structure:	**Week**	**Topic**
	1.	Basic concepts of kinematics. Newton's laws, Momentum and its conservation, Work, energy, power.
	2.	Conservative fields and potential energy. Torque.
	3.	Equilibrium of rigid bodies. Free and forced linear oscillations.
	4.	Hydrostatics.
	5.	First law of thermodynamics. Thermodynamics of gases, solids, and liquids.
	6.	Heat propagation. Electric charge, field, potential.
	7.	Conductors in electrostatic field. The flow of electric charges.
	8.	The concept of current, current density, voltage. Voltage sources, electromotive force.
	9.	DC circuits. Joule's law.
	10.	The concept of magnetic induction. Forces in a magnetic field.
	11.	Dia-, para-, and ferromagnetism. Ampere's law.
	12.	Electromagnetic induction. Neumann's law. Faraday's law of induction.
	13.	AC circuits. Ampere-Maxwell law. EM waves.
Required readings:	R.A. Serway and Chris Vuille: Essentials of College Physics, 2007, ISBN: 0-495-10619-4 P.A. Tipler and Gene Mosca: Physics for Scientists and Engineers, 2004, ISBN: 0-7167-0809-4, 0-7167-0810-8	
Recommended readings:	M. Alonso – E. J. Finn: Fundamental University Physics, Volume I., II., Addison-Wesley Publishing Company, 1979 D. Halliday – R. Resnick: Fundamentals of Physics, John Wiley & Sons, 1981	
Evaluation method:		

Course Description	
Course title:	Materials Science
Neptun code:	MAKFKT120B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	2l + 2p
Name and position of lecturer:	Prof. Peter Baumli
Contact of lecturer:	peter.baumli@uni-miskolc.hu
Prerequisite course(s):	

Language of the course:	English	
Suggested semester: autumn /spring, 1-6	1/autumn	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	In the course, students will learn about the structure of materials, from atomic composition to the molecular level. The aim is to understand the description of structures in condensed materials, exploring both order and disorder and how these can be characterized.	
Course structure:	**Week**	**Topic**
	1.	Chemical Bonds
	2.	Amorphous Materials
	3.	Lattice Types of Crystalline Materials
	4.	Characterization of Crystalline Lattices, Miller Indexing
	5.	Lattice Defects
	6.	Introduction to Phase Diagrams, Their Physico-Chemical Background
	7.	Introduction to Phase Diagrams, Their Physico-Chemical Background II
	8.	Interpretation of Magnetic and Electrical Properties
	9.	Interfaces and Interfacial Phenomena
	10.	Characterization of Ceramic Materials
	11.	Introduction to Polymers
	12.	Examination of Molecular Structure
	13.	Presentation of Semester Project
Required readings:	1. Materials Science and Engineering: An Introduction" by William D. Callister and David G. Rethwisch; 2. De Graef, M., & McHenry, M. E. (2012). The Structure of Materials (2nd ed.). Cambridge University Press.	
Recommended readings:	Gaskell, D. R. (2017). Introduction to the Thermodynamics of Materials (6th ed.). CRC Press.	
Evaluation method:	The students prepare a semester project work. After the submission of the semester work, the teacher evaluates it. Accepted the semester work, the students can start the Oral examination.	

Course Description	
Course title:	Scientific work technics for engineers
Neptun code:	MAKETT120B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	2p
Name and position of lecturer:	Helga Kovacs, PhD, associate professor
Contact of lecturer:	helga.kovacs@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	1/autumn
Number of credits:	2
Requirements (exam/practical mark/signature/report, essay):	practical mark

Course objectives (50-100 words):	Providing the IT knowledge necessary for the professional preparation of scientific data processing, documents, and presentations. Setting up and learning to use individual student Microsoft accounts.	
Course structure:	**Week**	**Topic**
	1.	A comprehensive presentation on the installation and use of the Microsoft 365 software package.
	2.	E-learning system of University of Miskolc
	3.	The art of editing scientific documents and presentations.
	4.	The theory of literature research and the application of related software, including database management.
	5.	The theory of literature research and the application of related software, including database management
	6.	Microsoft Word
	7.	Microsoft Word
	8.	Microsoft Excel
	9.	Microsoft Excel
	10.	Microsoft Excel
	11.	Microsoft Power Point
	12.	Test, 1st appointment, Student presentation of semester assigments
	13.	Test second appointment, Student presentation of semester assigments
Required readings:	"Educational videos in e-learning system, •https://support.microsoft.com/hu-hu/training •Naveed Saleh: The complete Guide to article writing, Writer's Digest Books, 2014 •Liam Lusk: Presentation Skills: How To Make A Great Presentation, Amazon Digital Services LLC, 2012 Michael Alexander, Richard Kusleika, John Walkenbach: Excel 2019 Bible, Wiley, 2018"	
Recommended readings:	"•Nick Moore: How to Do Research: A Practical Guide to Designing and Managing Research Projects, Facet, 2006"	
Evaluation method:	practical grade	

Course Description		
Course title:	Everyday's material knowledge	
Neptun code:	MAKFKT121B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l	
Name and position of lecturer:	Klara Hernadi, full professor	
Contact of lecturer:	klara.hernadi@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	1/autumn	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	report	
Course objectives (50-100 words):	Practical learning about the materials we use in our everyday lives. Critically processing the (online) knowledge that comes our way. Developing an	
Course structure:	**Week**	**Topic**
	1.	Atoms: the origin of the atoms' names, their occurrence in the world, in our everyday life, in biological systems and their role in them

	2.	A "hit list" of compounds: the fifty most produced chemicals in the world, their usage
	3.	Fuels for vehicles: characterization of the basic types; alternative (environmentally friendly) fuels; automotive catalytic converters
	4.	Our medicines: home pharmacy - most important everyday medicines; pharmaceutical manufacturing
	5.	Our food products: carbohydrates, proteins, lipids, vitamins, colours; food preservation; drinks
	6.	Our cleansing products: chemicals in our environment, their possible dangers
	7.	Natural and artificial objects in our environment: building materials, glass-ceramics, metal objects, etc.
	8.	Plastics: natural and synthetic plastics most commonly found in our environment
	9.	Lightweight yet strong structural materials for the 21st century: composite materials in architecture, automotive design, sports equipment, etc.
	10.	Environment in everyday life: air, water, soil: general exercises to reduce environmental pressures (recycled paper making new paper), household "hazardous waste"
	11.	
	12.	
	13.	
Required readings:	https://iupac.org/what-we-do/periodic-table-of-elements/ https://en.wikipedia.org/wiki/Motor_fuel and related pages https://en.wikipedia.org/wiki/Environmental_science	
Recommended readings:	https://en.wikipedia.org/wiki/Pharmaceutical_industry https://wellnessatnih.ors.od.nih.gov/Nutrition/Pages/Nutrition-Basics.aspx and related pages	
Evaluation method:	Completion of a 25-question test or giving your own presentation at the end of the semester	

Course Description		
Course title:	Descriptive Geometry	
Neptun code:	GEAGT104-B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	3p	
Name and position of lecturer:	József Túri, associate professor	
Contact of lecturer:	jozsef.turi@uni-miskolc,hu, room: 325 (A/4 building),	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	1/autumn	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	The main goal of the subject is constructive geometric sense, practical spatial perception and editorial work	
Course structure:	**Week**	**Topic**
	1.	Euclidean edits. axonometry, Monge projection. Representation of spatial elements.

	2.	Alignment and parallelism of space elements.
	3.	Punching a plane and a straight line, cutting two planes.
	4.	Introduction of a new image plane, target transformations.
	5.	Representation and thrusting of logs and gules with a straight line, its intersection with a plane.
	6.	Perpendicularity, plane parallel to image plane turning it into position. Distance, angle
	7.	Representation of a circle, properties of the ellipse image of the circle.
	8.	Representing a sphere, stabbing it with a straight line, intersection with a plane.
	9.	Representation and punching of a cylinder of rotation, a cone of rotation with a straight line. Intersection of a cylinder of revolution with a plane.
	10.	Plane sections of a cone of rotation. Cone slices.
	11.	Effect of rotation cone, rotation cylinder, sequencing, slicing.
	12.	Interaction of a cone of rotation with an intersecting axis and a cylinder for engineering tasks, auxiliary sphere method.
	13.	Interaction between cylinder and cylinder.
Required readings:	Kenson, Ervin (2009): Descriptive Geometry. University of Michigan Library Smith, William Grisworld (2023): Practical Descriptive Geometry. Legare Street Pr. Woolf, Solomon (2007): Elementary Course In Descriptive Geometry. Merchant Books	
Recommended readings:	Watts, Earle F. (2008): Desciptive Geometry. Watts Press	
Evaluation method:	Evaluation is done by written and oral assessment.	

Course Description		
Course title:	Mechanical Drawing-Machine Elements	
Neptun code:	GEGET224B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Dr. Sarka Ferenc, associate professor	
Contact of lecturer:	ferenc.sarka@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	2/spring	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is to introduce materials engineering students to the basic rules of mechanical drawing and the characteristics and operation of the most important machine components. Knowledge of mechanical drawing is essential for an engineer, because it is the basis of engineering communication. Those who complete the course will be able to communicate with others, even mechanical engineers, with technical drawings, and they will be able to perform simple sizing tasks.	
Course structure:	**Week**	**Topic**
	1.	Description of semester requirements. Apply drawing pages, text boxes, drawing types, projections, sections, cut-out. General description of drawing techniques. Preparation of the drawing sheet, entering and filling in the text field. Description of drawing tools. Basic editing techniques (parallel, perpendicular, etc.)

	2.	Construction of dimensions, specification of dimensional tolerances, positional tolerances, and surface qualities. Task 1: Drawing a simple part. Edited, pencil drawing on paper
	3.	Representation of bolted connections. Representation and specification of different joints. Submission of task 1
	4.	Specifying shafts, shaft-hub connections. Task 2: Representation of a screw connection. Component drawing of hexagon head screw, hexagonal nut, spring washer.
	5.	Representation of toothed machine elements. Gear, Sprocket. Task 2 - creating an assembly drawing
	6.	Properties of assembly drawings, applied markings, other accessories. Submission of task 2 - making an assembly drawing.
	7.	Design process and its steps. Basic concepts of sizing. Task 3: Making a drawing of the shaft end bearing unit
	8.	Shafts, shaft-hub connections, bearings. Task 3: Making a drawing of the shaft end bearing unit.
	9.	Bearings, bearing units, seals and gaskets. Task 3: Service life calculation of bearing.
	10.	Couplings, shafts. Task 4: Making a sleve clutch report.
	11.	Fasteners, toothed machine elements, gear drives. Sleve clutch editing, pencil drawing, on drawing sheet
	12.	Manufacturing processes of gear elements, special gears, failures. Sleve clutch editing, pencil drawing, on drawing sheet
	13.	Correcting and replacing faulty tasks.
Required readings:	• Stefano Tornincasa: Technical Drawing for Product Design, 2024, Springer, ISBN 978-3-031-51186-8. • Joseph E. Shigley - Charles R. Mischke – Richard G. Budynas: Mechanical Engineering Design. McGrawHill 2004, ISBN 007-252036-1	
Recommended readings:	Bernard J. Hamrock – Bo Jacobson – Steven R. Schmid – Fundamentals of Machine Elements. McGraw-Hill, 1999, ISBN 0-25-19069-0	
Evaluation method:	The subject is completed by teacher's signatute and taking an exam. In order to obtain a signature, the mid-year tasks must be submitted by the deadline, and must be prepared at least to a sufficient level (they must not contain calculation errors, free of drawing errors). You have to be there for 70% of the practical lessons and 60% of the lectures. Attendance is checked each time by the instructors. The written exam is mandatory. The exam is evaluated on a five grade scale. The oral part can be taken in case of a doubtful mark or at the request of the student, if the written part is at least of a sufficient level. The rounded value of the average of the grades received for the four mid-year tasks is counted in the exam grade with one third of the weight. The exam is passed if at least 50% of the obtainable points are obtained. Grades: average from 65%, good from 80%, excellent from 90%.	

Course Description		
Course title:	Energy production and transformation	
Neptun code:	MAKETT301B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l	
Name and position of lecturer:	Helga Kovacs, PhD, associate professor	
Contact of lecturer:	helga.kovacs@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	2/spring	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is to introduce students to the concept of energy and its production possibilities. It provides a brief overview of energy carriers and, focusing on the main energy production and conversion technologies (combustion, gasification, pyrolysis), presents the processes, advantages, and disadvantages of each technology, taking into account environmental and economic aspects. The course primarily concentrates on technologies related to materials engineering. In addition to the currently used technologies, it also provides insight into the world of innovative methods.	
Course structure:	**Week**	**Topic**
	1.	Energy sources, statistics

	2.	Energy sources, statistics
	3.	Raction kinetics
	4.	Theory of combustion
	5.	Theory of combustion
	6.	Theory of combustion
	7.	Theory of gasification
	8.	Theory of pyrolysis
	9.	Electric systems and grids
	10.	Energy related calculations
	11.	Energy related calculations
	12.	Test, 1st appointment
	13.	Test, 2nd appointment
Required readings:	Energy from Waste, ISBN 978-0-08-101042-6, Combsution, ISBN 978-0-12-407913-7	
Recommended readings:	Waste-to-Energy, ISBN: 9780128160800	
Evaluation method:	Exam grading	

Course Description		
Course title:	Heat transfer calculations	
Neptun code:	MAKETT121B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2p	
Name and position of lecturer:	Dr. Kállay Andraás Arnold, senior researcher	
Contact of lecturer:	andras.kallay@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	2/spring	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	In the lectures, students will learn about the theoretical description (differential equations) of heat conduction, convection and radiative heat transfer processes. In the practical exercises, they will learn about the methods of calculating these processes under time-steady and time-varying conditions, with special emphasis on modern computational solutions.	
Course structure:	**Week**	**Topic**
	1.	Description of requirements. Review of the semester's syllabus.
	2.	Mathematical foundations of transport equations
	3.	The heat flow transport equation
	4.	Stationary problems I.
	5.	Stationary problems II.
	6.	Transient problems
	7.	1st. midterm exam
	8.	Radiative heat transfer
	9.	Spectrum of radiation, radiometry
	10.	Radiative subfactors
	11.	Numerical methods
	12.	Coupled problems

	13.	2nd. midterm exam
Required readings:		Frank P. Incropera, David P. DeWitt: Fundamentals of Heat and Mass Transfer, John Wiley & Sons, 2002. Franz Beneke, Bernhard Nacke, Herbert Pfeifer: Handbook of thermoprocessing technologies, Vulkan Verlag Gmbh, 2012.
Recommended readings:		C. E. Baukal, Jr.: Heat Transfer in Industrial Combustion, CRC Press LLC, 2000Franz Beneke, Yeshvant V. Deshmukh: Industrial Heating: Principles, Techniques, Materials, Applications, and Design, CRC Press, 2005. Bird, R.B., Stewart, W.E. and Lightfoot, E.N.: Transport Phenomena, John Wiley & Sons, 2007
Evaluation method:		Signature requirements during the semester: - min 70% of lectures and min. Active participation in 70% of the lectures and 70% of the practicals, - Successful completion (at least 50%) of 2 final exams, The course is completed by: signature + exam Evaluation: grading from 1 to 5.

Course Description		
Course title:	Investigation of Material Structure	
Neptun code:	MAKFKT101-22-B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Dr. Márton Benke, professor	
Contact of lecturer:	marton.benke@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	2/spring	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is the education of fundamental examination methods and the theoretical basics and application fields of the most relevant micro-, macro- and crystal structure examination methods of solid materials.	
Course structure:	**Week**	**Topic**
	1.	Outline, objectice and equipment park of material structure examinations
	2.	Lightl microscopy I.
	3.	Light microscopy II.
	4.	Principles of X-ray diffraction
	5.	X-ray diffraction qualitative phase analysis
	6.	X-ray diffraction residual stress measurements
	7.	Scanning electron microscopy I.
	8.	Scanning electron microscopy II.
	9.	Transmission electron microscopy I.
	10.	Transmission electron microscopy II.
	11.	Cumpoted tomography
	12.	Midterm test
	13.	Consultation
Required readings:	A. D. Krawitz, Introduction to Diffraction in Materials Science and Engineering, Wiley & Sons, Hoboken, 2001.	
Recommended readings:		
Evaluation method:	midterm test	

Course Description		
Course title:	CAD	
Neptun code:	MAKÖNT120B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	3p	
Name and position of lecturer:	Janos Erdelyi, Phd associate professor	
Contact of lecturer:	janos.erdelyi@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	3/autumn	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	Presentation of CAD technologies. Learning about three-dimensional parametric modeling. Three-dimensional parametric modeling is presented within the framework of the course. The students they gain insight into the application possibilities of a market-leading software. The body modeling function is detailed by presenting them, they acquire knowledge for creating the geometry of parts. The different material through addition and removal options, tailoring patterns, holes, ribs, chamfers, etc. geometric we present the preparation of features. Models created in the component module, 2D representation, technical preparation of documentation. Getting to know assemblies, simpler forcing methods, complex construction of virtual models	
Course structure:	**Week**	**Topic**
	1.	Familiarization with the use of a 3D CAD software (Solid Edge).
	2.	material addition commands (protrusion, revolved protrusion, helical protrusion, swept protrusion)
	3.	material removal commands (cutout, revolved cutout, helical cutout, swept cutout)
	4.	hole making command (threaded, tapered, countersunk)
	5.	Distribution (round and rectangular distributions)
	6.	roundings, chamfers, lateral bevels
	7.	mirroring, moving, copying (between bodies)
	8.	other operations
	9.	Assemblies (Assembly module)
	10.	Assemblies (Assembly module)
	11.	Different types of VEM analysis
	12.	Getting to know the Drawing/Draft module
	13.	Test (drawing)
Required readings:	1. Solid Edge tutorial module (electronic, part of the software) 2. Solid Edge online manual (electronic, software part)	
Recommended readings:	Siemens Solid Edge Youtube chanel	
Evaluation method:	Test (60% for succes)	

Course Description	
Course title:	Physical metallurgy
Neptun code:	MAKFKT225-22-B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	3l + 3p
Name and position of lecturer:	Prof. Dr. Valeria Mertinger
Contact of lecturer:	valeria.mertinger@uni-miskolc.hu
Prerequisite course(s):	

Language of the course:	English	
Suggested semester: autumn /spring, 1-6	3/autumn	
Number of credits:	6	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the subject is to provide a general and alloy-specific understanding of the metallurgical processes involved in the production of a metal component (crystallisation, heat treatment, deformation) and to apply these processes in a conscious manner. To learn about new developments and scientific results in the field of iron, aluminium, copper and the most important metal alloys. To provide theoretical and practical knowledge of the basic metallic disciplines.	
Course structure:	**Week**	**Topic**
	1.	Crystallization, solid state transformations
	2.	Equilibrium conditions of ferrous alloys. Binary ferrous alloys, Ternary alloys.
	3.	Equilibrium and non-equilibrium transformations, Transformation diagrams, factors influencing them.
	4.	Effect of heating below A1
	5.	Mechanical properties of steels (mechanical properties of materials). Mechanisms of plastic deformation. Contaminants in steels
	6.	Cast steel. Main alloy steel types,
	7.	Heat treatment of steels
	8.	Cast irons.
	9.	Summary of the mechanisms of strength increase, forming chemistry.Grain structure, solid solution hardening, precipitation hardening. Comparison of strain hardening in steel and aluminium alloys.
	10.	Aluminium alloys equilibrium diagrams, industrial Al alloys csop.
	11.	Light metals. Titanium and its alloys Beryllium, Magnesium
	12.	Copper alloys. Copper and its properties. Copper and its alloys. Equilibrium diagrams. Major alloys
	13.	Zn, tin, lead and precious metals
Required readings:	[1] H.K.D.H. Bhadeshia: Steels Microsructure and properties, Elsevier, 2006	
Recommended readings:	[1] Otsuka Shape Memory Materials, Cambridge University Press, 1998	
Evaluation method:	Mid-term examination and assessment: final examination. Practical reports and multiple-choice test after the practical. Semester mark: At least satisfactory final examination and completion of all exercises. The final examination may be substituted 1 time! One make-up is possible in the last week of the semester. In other words, more than 1 absence of practice will result in an automatic REFUSAL of the signature. A test will be uploaded via the university Moodle system after the exercises. After completing the internship, you will be asked to upload the documents proving the completion of the internship and to complete a multiple-choice test. Method of completion and assessment: oral examination, preceded by a minimum knowledge test in the form of a written test (pop-up). The oral test is taken during the pre-examination period. The mark will depend on the performance on the day.	

Course Description	
Course title:	Theory of Ceramics
Neptun code:	MAKKSZ218-22-B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	3l + 3p
Name and position of lecturer:	Kocserha István, associate professor
Contact of lecturer:	istvan.kocserha@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	3/autumn
Number of credits:	6
Requirements (exam/practical mark/signature/report, essay):	exam

Course objectives (50-100 words):	Overview and brief history of traditional silicate-based and technical ceramics. Structure and properties of ceramic materials and their characterisation. Introduction to the raw materials and their characteristics of traditional and technical ceramics. Acquiring a basic knowledge of engineering of the ceramics used today and their related technologies, understanding the mechanisms of action of the factors influencing their physical, chemical and mechanical properties. Acquisition of testing and evaluation methods at BSc level.	
Course structure:	**Week**	**Topic**
	1.	Introduction, subject requirements. Concept of ceramics, applications of traditional and technical ceramics.
	2.	History of ceramic materials. Structural principles of ceramics.
	3.	Basic materials of traditional ceramic materials. Two and three component phase diagrams and their interpretation.
	4.	Properties of traditional and technical ceramic materials I.
	5.	Properties of traditional and technical ceramics II.
	6.	Shaping technologies of traditional and technical ceramics I.
	7.	Shaping technologies of traditional and technical ceramics II.
	8.	Production technology of traditional and technical ceramics I.
	9.	Production technology of traditional and technical ceramics II.
	10.	Heat treatment of ceramics.
	11.	Refractory ceramic materials.
	12.	Glasses and glazes. Production technologies.
	13.	Cement and concrete. Production technologies.
	14.	Brick and tile manufacturing technology.
Required readings:	M V Barsoum. Fundamentals of Ceramics, CRC Press, (2003)	
Recommended readings:	Philippe Boch, Jean-Claude Niepce: Ceramic Materials, Wiley-ISTE, (2006)	
Evaluation method:	Written and oral exam. Students will be given a series of tests on the topics of the lectures, which they must complete on paper. Time allowed: 2 hours. After correction of the written test, the student will receive a mark, which he/she may either accept or correct by oral examination. Written test, graded from 1 to 5 marks. Grading :<60%: unsatisfactory; 60-70%: satisfactory; 70-80%: average; 80-90%: good; >90%: excellent	

Course Description	
Course title:	Polymer study
Neptun code:	MAKPOL228-22-B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	3l + 3p
Name and position of lecturer:	Dr. Tamas J. Szabo, associate professor
Contact of lecturer:	tamas.szabo@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	3/autumn
Number of credits:	6
Requirements (exam/practical mark/signature/report, essay):	exam

Course objectives (50-100 words):	Definition of the concept of polymers and plastics. Creation of polymer molecules. Characterization of polymers, molecular weight, polydispersity. Spatial structure, tacticity. Polymer molecular mobility, properties. Polymers, industries based on polymers. Production of macromolecules, polymerization, copolymerization, polyaddition, polycondensation. Plastics. The most important concepts, the components of plastics (polymers, plasticizers, fillers), plastic types. Mass plastics (PE, PP, PS, PVC), technical plastics (POM, PA, PES). Processing of plastic materials. Basic concepts of melt rheology, flow models, calendering, extrusion, injection molding, pressing, casting, special processes. Properties of plastics and investigation. Viscoelastic models, definitions, mechanical properties, modulus of elasticity, large deformations, tensile impact tests, orientation, creep, shrinkage, relaxation phenomena, models, time-temperature superposition, electrical properties, dielectric conduction, insulating capacity, dielectric strenght, melt rheology.	
Course structure:	**Week**	**Topic**
	1.	1. Chemistry quiz. Macromolecules characteristics. Concept definitions. History of polymer technology and polymer science.
	2.	2. Reactions leading to the formation of polymers. Polymerization, polycondensation, polyaddition. Main chain structure and properties relationship between (Heteroatoms, rings).
	3.	3. Molecular weight of the polymer. Interpretation of number and mass averages. Polydispersity. Isomerism in polymers.Tacticity. Cross-linked polymers.
	4.	4. Physical states of the polymer. The glass transition, the highly elastic state. Segment interpretation. Relaxation time. Viscoelastic models I.
	5.	5. The principle of time-temperature superposition. Polystyrene, PVC, PMMA, polyacrylonitrile.
	6.	6. Additive systems for plastics. Plasticizers, stabilizers, fillers.
	7.	7. Polymer analogue transformations. Copolymers types, their production. Structure property connections.
	8.	8. Polyolefins. Production, properties. THE crystallinity of polymers, crystallinity effect on properties.
	9.	9. Polycondensation plastics. Linear and cross-linked condensation products. Polyesters, polyamides, phenolic resins, aminoplasts.
	10.	10. Viscosity of polymer solutions. The relative- a the concept of specific and limiting viscosity, relationship between the molecular weight and the between viscosity.
	11.	11. Viscoelastic models II. Polymer basics of rheology of melts.
	12.	12. Mixing polymers, polymer blends. Lifetime of plastics. Recycling (recycling) issues
	13.	
Required readings:	1. Pukánszky Béla: Műanyagok BME Műanyag-és Gumiipari Tanszék, Budapest, 2003. 2. Rodriguez, F.: Principles of polymer sytems, McGraw-Hill, 1987	

Recommended readings:	1. Cvikovszky Tibor, Nagy P., Gaál J.: A polimertechnika alapjai, Műegyetemi Könyvkiadó, Budapest 2000. 2. Bodor Géza: A polimerek szerkezete, Műszaki Könyvkiadó, 1982. 3. Ritche,P.D.: Lágyítók, stabilizátorok, töltőanyagok, Műszaki Könyvkiadó, 1976. 4. Hedvig Péter: Elektromos vezetés és polarizáció műanyagokban, Akadémiai Kiadó, Budapest, 1969. 5. Hedvig Péter: Dielectric spectroscopy of polymers, Akadémiai Kiadó, Budapest, 1977
Evaluation method:	Grading on a scale of 1-5, written exam with the possibility of oral correction

Course Description		
Course title:	Furnances and Burners	
Neptun code:	MAKETT302-22-B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Csaba Póliska PhD, associate professor	
Contact of lecturer:	csaba.poliska@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	3/autumn	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of teaching the subject is to learn the structure and operating conditions of modern silicate and ceramic, refractory and chemical industry furnaces and melting equipment.	
Course structure:	**Week**	**Topic**
	1.	Heat transfer of furnaces, types of furnaces.
	2.	Types and characteristics of chamber furnaces.
	3.	The structure, operation, refractory materials, firing and flow system of glass melting furnaces.
	4.	Structure, operation, firing, flow system, temperature distribution of pusher type and walking beam furnaces.
	5.	Structure, operation, firing, flow system, temperature distribution of carousel furnaces.
	6.	Structure, operation, firing, flow system, temperature distribution of tunnel kilns.
	7.	Structure, operation, firing and flow system of cement industry and waste incineration rotary kiln, temperature field of the equipment.
	8.	Structural design, operation, firing and flow system of shaft and double shaft furnaces, characteristic temperature distribution, feasible technologies.
	9.	Purpose and operation of tube furnaces.
	10.	Resistance heating and electric arc furnaces.
	11.	Energy balance and efficiency of furnaces.
	12.	Special furnaces
	13.	Written test
Required readings:	B. G. Miller, D. A. Tillman: Combustion Engineering Issues for solid Fuel Systems, Elsevier, 2008. P. Mullinger, B. Jenkins: Industrial and process furnaces, Elsevier Ltd. 2008. M. Lackner, F. Winter, A. K. Agarwal: Handbook of Combustion, 5 Volume Set, Wiley VCH Verlag GmbH, 2010.	
Recommended readings:	M. Lackner, Á. B. Palotás, F. Winter: Combustion (From basics to applications), Wiley-VCH, Weinheim, 2013.	
Evaluation method:	Written test, grade 1-5. Grading scale: >90 %: excellent, 80-89 %: good, 65-79 %: medium, 50-64 %: satisfactory, <50 %: unsatisfactory.	

Course Description

Course title:	Quality affair	
Neptun code:	MAKMKT214-17-B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l	
Name and position of lecturer:	Eva Stumpf	
Contact of lecturer:	eva.stumpf@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	4/spring	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	Students get to know the theoretical background of quality (mainly quality management, quality assurance and quality control) and the most common quality tools in the production of raw materials and components. The aim of the course is for the students to recognize and understand the practical methods of quality when they enter the industry, thereby being able to effectively support the operation of quality systems and the production of consistent product quality.	
Course structure:	**Week**	**Topic**
	1.	Concept of quality. Structure of customer needs.
	2.	Historical development of quality matters, presentation of the branches of quality matters.
	3.	Basic principles of quality management. Use of quality management systems.
	4.	Identification and classification of company processes.
	5.	Measurement and monitoring of processes.
	6.	Quality management system documents. System certification principles.
	7.	Basic principles of quality control. Means of declaring customer requirements.
	8.	Machine drawing and standard theory.
	9.	Quality control design tools. Place of quality control in the product production process.
	10.	Test methods. Principles of selection of measuring and testing devices.
	11.	Principle and necessity of calibration and authentication. Quality certification practice. The essence of CE marking, prerequisites for logo usage rights.
	12.	Methods of artificial authentication of metal products. Legal institutions for standing up for quality
	13.	Importance of quality costs. classification and types of quality costs.
Required readings:	lesson notes	
Recommended readings:	Decision 768/2008/EC of the European Parliament and the Council (July 9, 2008) on the marketing of products on the common framework of its adoption	
Evaluation method:	midterm test, written exam (1 - 5 grade scale)	

Course Description	
Course title:	Engineering Calculations
Neptun code:	MAKFKT105B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	1l + 2p
Name and position of lecturer:	Dr. Máté Szűcs
Contact of lecturer:	mate.szucs@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	4/spring

Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	General description and classification of computer algebra systems and teaching of a general-purpose computer algebra system (Maple) suitable for performing numerical and symbolic calculations related to engineering tasks. The student who has mastered the subject is able to solve equations and systems of equations symbolically and numerically, to apply integral and differential calculus, including differential equations. The student understands the basic questions of the mathematization of engineering problems, the need to analyze, check, and evaluate computer results.	
Course structure:	**Week**	**Topic**
	1.	Programming technical, mathematical, theoretical background
	2.	Programming technical, mathematical, theoretical background
	3.	Programming technical, mathematical, theoretical background
	4.	Programming technical, mathematical, theoretical background
	5.	Maple calculation exercises
	6.	Maple calculation exercises
	7.	Maple calculation exercises
	8.	Maple calculation exercises
	9.	Maple calculation exercises
	10.	Individual engineering-mathematical tasks presenting his background.
	11.	Individual consultation, special tasks programming
	12.	Individual consultation, special tasks programming
	13.	Individual consultation, special tasks programming
Required readings:	Gergó Lajos - Horváth András - Kallós Gábor - Molnárka Győző - Wettl Ferenc B.: A Maple V és alkal mazásai, Springer Hungarica Kiadó Kft., 1996;	
Recommended readings:	FRANK GARVAN : The MAPLE BOOK	
Evaluation method:	Completion of an individual simulation task until the (last) week before the end of the study period of the semester, the student's performance for the semester will be evaluated based on the completed task.	

Course Description	
Course title:	Powder technology
Neptun code:	MAKKSZ219-22-B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	2l + 1p
Name and position of lecturer:	Kocserha István, associate professor
Contact of lecturer:	istvan.kocserha@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	4/spring
Number of credits:	3
Requirements (exam/practical mark/signature/report, essay):	exam

Course objectives (50-100 words):	General properties of powders. Particle size, grain shape, surface "roughness", hardness, mechanical strength, micro- and macro-structure, porosity, moisture content. Different interpretations of grain diameter, determination and calculation of specific surface area and grain sizes. Preparation of powders: comminution and grinding. Theory and machinery of grinding and milling. Pulverized drying of powders. Separation of powders by particle size and composition; design and principle of operation of separation equipment. Transport and storage of powders. Separation and filtration of powders from air - process equipment. Equipment for mixing and homogenising powders.	
Course structure:	**Week**	**Topic**
	1.	Materials, types and characteristics of powders. The most typical operational steps of powder technologies. Morphology of powders - importance of grain shape, grain size and grain structure.
	2.	Theoretical principles of grinding and milling of materials. Evolution of grinding theories to the present day. Production of powders by comminution. Working principle and design of mechanical crushers.
	3.	Production of powders by grinding. Equipment for fine grinding - working principle and construction of mills.
	4.	Specific powder production processes. Technologies for the production of natural and synthetic ceramic powders. Spray drying.
	5.	Production of powders by spray drying, mechanical equipment for the technology.
	6.	Construction, characteristics and design aspects of powder storage silos. Silo filling and emptying procedures. Screw transport of powders.
	7.	Pneumatic transport of powders, types. Separation and classification of powders from air. Air separators.
	8.	Classification, separation of powders. Principle of operation of industrial flat sieves, drum sieves and wind classifiers; construction design.
	9.	Dosing of powders, principle of operation of vibrating, disc, cabinet, auger and cellular feeders; construction.
	10.	Separation of powders from air. Gravity separators. Determination of limiting particle diameter.
	11.	Separation of dusts from air. Operation of cyclones. Determination of boundary particle diameter.
	12.	Filtration of dusts from gases.
	13.	Filters, electrostatic precipitation.
	14.	Mixing and homogenisation of powders.
Required readings:	C.R.Woodcock, J.S.Mason: Bulk Solids Handling. Chapmanand Hall	
Recommended readings:		
Evaluation method:	Written and oral exam. Students will be given a series of tests on the topics of the lectures, which they must complete on paper. Time allowed: 2 hours. After correction of the written test, the student will receive a mark, which he/she may either accept or correct by oral examination. Written test, graded from 1 to 5 marks. Grading :<60%: unsatisfactory; 60-70%: satisfactory; 70-80%: average; 80-90%: good; >90%: excellent	

Course Description	
Course title:	Introduction to electronics
Neptun code:	MAKKSZ241B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	2l + 2p
Name and position of lecturer:	Kocserha István, associate professor
Contact of lecturer:	istvan.kocserha@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	5/autumn
Number of credits:	4
Requirements (exam/practical mark/signature/report, essay):	exam

Course objectives (50-100 words):	Within the framework of the course, students will get acquainted with the basics and basic phenomena of electrical engineering. In exercises following the lectures, students will acquire basic knowledge and measurement skills through the assembly, calculation and measurement of simple circuits.	
Course structure:	**Week**	**Topic**
	1.	Introduction. Structure of the electricity network in Hungary. Direct current networks. Voltage, current, Ohm's law. Elements of electrical networks.
	2.	Common active and passive networks. Network laws. Network calculation theorems.
	3.	Basics of measurement. Wheastone bridge operation.
	4.	Types and operation of sensors used in metrology.
	5.	Alternating current networks. Sinusoidal voltage generation and sinusoidal networks.
	6.	Alternating current networks. RLC circuits.
	7.	Three phase systems. Star and delta circuits. Capacities.
	8.	Transformers. Construction working principle. Substitution switching.
	9.	Transformers. Three-phase transformers. Special transformers.
	10.	Construction and working principle of electrical machines.
	11.	Asynchronous motors. Construction, working principle, circuit model. Load conditions. Power relations
	12.	Asynchronous motors. Torque slip characteristic curve. Starting, braking, reversing. Speed variation
	13.	Synchronous generators. Construction, operating principle, circuit model.
	14.	DC machines. Construction, operating principle, circuit model. Excitation modes, motor and generator operation. Model curves
Required readings:	1. Published presentation materials in pdf format 2. Uray-Szabó: Electrotechnics textbook, Technical Publisher, Budapest, 1994	
Recommended readings:	Electrical engineering guides on the web.	
Evaluation method:	Condition of signature: Passing 2 tests at a satisfactory level (satisfactory level: 50%), Attendance of at least 50% of the lectures and at least 100% of the practical course. Written and oral exam. Candidates will be given 20 items from a pre-assigned list of 200 minimum questions, which they must complete on paper. Time allowed: 40 minutes. To obtain a pass mark, the candidate must answer at least 12 questions (60%) correctly. To achieve a better mark (3, 4, 5), the exam must be continued with oral questions and answers.	

Course Description	
Course title:	Special Materials
Neptun code:	MAKFKT104B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	2l
Name and position of lecturer:	Mende Tamás, associate professor
Contact of lecturer:	tamas.mende@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	5/autumn
Number of credits:	3
Requirements (exam/practical mark/signature/report, essay):	report

Course objectives (50-100 words):	During lectures presented by invited speakers, the students get to know a wide variety of special materials, which are as follows: metal matrix composites, block nanostructured materials, amorphous materials, eutectics, special steels and shape memory alloys, historical metals and technology, special composites, materials for electric transmission lines, high-entropy alloys , welding technology materials.	
Course structure:	**Week**	**Topic**
	1.	Introduction
	2.	Historical metals and their technologies
	3.	Special steels and shape memory alloys
	4.	Materials containing eutectic
	5.	Special materials and their production
	6.	Amorphous materials
	7.	Metal matrix composites
	8.	Materials of electric transmission lines
	9.	Study break
	10.	Materials used in space
	11.	Presentations
	12.	Compensation for missed hours
	13.	
Required readings:	Metals Handbook, Vol 20, Materials Selection and Design,1997 W.D. Callister Materials Science and Engineering an Introduction, John Wiley&Sons 2007	
Recommended readings:	-	
Evaluation method:	Making ppt presentation	

Course Description		
Course title:	Additive technologies	
Neptun code:	MAKÖNT126-22-B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Laszló Varga, Phd, Associate Professor	
Contact of lecturer:	laszlo.varga1@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	5/autumn	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	AM technology allows the designer to work with only a small number of restrictions, thereby having the freedom to place the chosen according to the function of the design materials in space, exactly where needed. This significantly reduces the material used quantity, reduces the weight, so in combination with the digitally available design units, it is perfect can provide topological optimization to the manufactured product. The procedure essentially provides complete freedom for the designer, thus the geometry to be manufactured its complexity does not mean additional costs when using AM technology, as it is not required to make / put into operation additional tools. No need to recalibrate the tools, that is for further training of operators, and there is no significant additional time requirement either.	
Course structure:	**Week**	**Topic**
	1.	History of the development of AM technologies.

	2.	Presentation of the advantages of using AM technologies, areas of application.
	3.	General production process of AM technologies, additional processes.
	4.	Grouping of AM technologies: material extrusion, directed energy deposition (DED), material jetting, binder jetting, sheet lamination (LOM, UAM),
	5.	Vat polymerisation, Powder bed fusion (PBF).
	6.	Presentation of the metallic additive technologies used today: Nanoparticle jetting, Binder jetting, DMLS (direct metal laser sintering),
	7.	DMLM (direct metal laser melting), SLM (selective laser melting),
	8.	SLS (selective laser sintering), EBM (electron beam melting),
	9.	LENS (laser engineering net shape), EBAM (electron beam additive manufacturing).
	10.	Aspects of the choice of additive technologies.
	11.	Application case studies for different AM technologies.
	12.	Development guidelines, business benefits
	13.	Test
Required readings:	[2] Roche Industry – The Ultimate Guide: Everything need to know about 3D printing services https://www.rocheindustry.com/3d-printing-ultimate-guide	
Recommended readings:	Additive Manufacturing Technologies: Current Status and Future Perspectives Amirah Alammar DDS, John C. Kois DMD, MSD, Marta Revilla-León DDS, MSD, PhD, Wael Att DDS, Dr Med Dent, PhD, 21 March 2022, https://doi.org/10.1111/jopr.13477	
Evaluation method:	semester technology complex task, test	

Course Description		
Course title:	Waste utilization	
Neptun code:	MAKETT304-22-B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	1l + 2p	
Name and position of lecturer:	Dr. Gábor Nagy	
Contact of lecturer:	gabor.nagy2@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	5/autumn	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	Within the framework of the subject, students will learn about the types of waste and their sources of generation. In addition to these, the utilization or disposal options of waste are also presented.	
Course structure:	**Week**	**Topic**
	1.	Overview of basic concepts related to waste and the relevant legal regulations
	2.	Wood waste
	3.	Paper waste
	4.	Food waste and other biodegradable wastes
	5.	Metal waste
	6.	Glass waste
	7.	Construction and demolition waste
	8.	Battery waste

	9.	Electronic waste
	10.	End-of-life vehicles
	11.	Waste tires
	12.	Other industrial wastes
	13.	Test
Required readings:	Letcher, Trevor M.; Vallero, Daniel A.: Waste : a handbook for management. Academic Press, 2011. Information Reso Management Association: Waste Management: Concepts, Methodologies, Tools, and Applications, 3 volume. Engineering Science Reference, 2019.	
Recommended readings:	Stefan Scheuer: EU Environmental Policy Handbook. Commission Communication, Brussels, 2005. Vera Weghmann: Waste Management in Europa. EPSU, 2023.	
Evaluation method:	Test results	

Course Description		
Course title:	Management and Business studies	
Neptun code:	MAKMKT215VB	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l	
Name and position of lecturer:	Prof. Dr. Csaba Deák, University Professor	
Contact of lecturer:	csaba.deak@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is to acquire the fundamentals of business and management knowledge. Students will become familiar with the tools of entrepreneurship development methodology, which contribute to the correct interpretation of the operational foundations of enterprises. Examples from domestic and international corporate cases are also covered.	
Course structure:	**Week**	**Topic**
	1.	Introduction / Discussion of tasks
	2.	Leadership 1: The leader's personality
	3.	Leadership 2: Team development, Difficult conversations
	4.	The driving force of innovation: Basics, Types, Strategy
	5.	Leadership 3: How to motivate your team? Praise and criticism
	6.	Starting a business 1: Idea search, Creative techniques, Idea generation
	7.	Successful entrepreneur guest lecture
	8.	Business Model Canvas (Student presentations)
	9.	Starting a business 2: Project implementation, Mini Business Case task
	10.	Starting a business 3: Product and service development, Process development, Business model development
	11.	Business plan
	12.	Assessment: Presentations
	13.	Closing Remarks and Final Discussion
Required readings:	"Entrepreneurship: Theory, Process, and Practice" by Donald F. Kuratko ISBN: 978-1305576247	
Recommended readings:	"Leadership: Theory and Practice" by Peter G. Northouse ISBN: 978-1506362311	

Evaluation method:	Evaluation method: Mid-term assessment: Written test and group assignment (uploaded to Microsoft Teams). Components: Leadership e-learning (1+4 modules: 20%), Business Model Canvas and presentation (in pairs: 25%), Mini Business Case task (25%), Theory (final assessment in class: 30%), Active participation (10%).

Course Description		
Course title:	Environmental Protection	
Neptun code:	MAKETT124B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l	
Name and position of lecturer:	Dr. Gábor Nagy	
Contact of lecturer:	gabor.nagy2@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is for students to acquire comprehensive knowledge about environmental protection. This includes the cycles of environmental elements and the effects of industrial activities affecting them. Furthermore, within the framework of the subject, students will learn about the basic means of protecting air, water and soil.	
Course structure:	**Week**	**Topic**
	1.	Basic concepts, legislation
	2.	Environmental cycles
	3.	Air pollution (characterization of pollutants, sources, air quality, solutions to reduce air pollutants)
	4.	
	5.	
	6.	
	7.	Water pollution (surface and groundwater pollutants, water quality characterization, pollution sources, wastewater treatment)
	8.	
	9.	Soil pollution (soil pollution types, remediation)
	10.	
	11.	Generation, utilization and disposal of waste
	12.	
	13.	Test
Required readings:	Anndrew Farmer: Handbook of Environmental Protection and Enforcement, Earthscan, 2007. Sven Erik Jørgensen: Principles of pollution abatement: pollution abatement for the 21st century. Elsevier, New York, 2000.	
Recommended readings:	Stefan Scheuer: EU Environmental Policy Handbook. Commission Communication, Brussels, 2005. Trust for Public Land and American Water Works Association: Source Protection Handbook. 2021.	
Evaluation method:	Written exam	

Course Description	
Course title:	Metallic materials
Neptun code:	MAKFKT128-22-B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	2l +2p

Name and position of lecturer:	Prof. Dr. Valeria Mertinger	
Contact of lecturer:	valeria.mertinger@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The course synthesizes the knowledge acquired in the heat treatment specialization and introduces students to metallic structural materials and the solution of metallurgical problems arising in their application through many practical examples. It specifically develops problem-solving skills.	
Course structure:	**Week**	**Topic**
	1.	Introduction, Technology. the triple role of structure and property with examples.
	2.	Crystallisation, crystallisation-related technologies and related structural and metallurgical problems.
	3.	An overview of the structural changes associated with ductile formation and related metallurgical problems.
	4.	Solid solution, solid solution + second phase type structures, their formation and properties.
	5.	Ferroalloys - Non-ferrous metal grades. Solid solution ferrous alloys- Cold suction steels, Materials with guaranteed expansion properties, Soft magnetic materials, Corrosion resistant steels, Heat resistant steels
	6.	Non-alloy ferrous alloys with ferrite+ carbide fabric structure.
	7.	Iron alloys with solid solution + carbide fabric structure: stainless, spring, hardenable from inserts, ball bearings, tool steels
	8.	Ferrous alloys with solid solution + carbide + other phase fabric structure: automatic steels, cast irons
	9.	Light metals, Al, Mg, Be alloys. Ti alloys, Low melting point alloys
	10.	Copper and its alloys.
	11.	Special alloys I: Superalloys, Shape memory alloys. Special alloys II: Amorphous materials,
	12.	Case studies. individual presentations
	13.	
Required readings:	ASM Spec,. Handbook, Aluminium and Aluminium Alloys, ASM International 1996[1] Otsuka Shape Memory Materials, Cambridge University Press, 1998 Krauss Principles of Heat treatment of Steel Askeland: The science and engineering of materials, PWS Publishing Company, 1989 W.D. Callister Materials science and engineering an introduction, John Wiley&Sons 2007 Van Vlack: Materials for engineering, Addison Wesley Publishing Company, 1982 Van Vlack: Elements of Materials Science and Engineering, Addison Wesley Publishing Company, 1982	
Recommended readings:	Wiedemann: Structural materials, Open University, 1990 Van Vlack: Materials for engineering, Addison Wesley Publishing Company, 1982 C.R. Brooks: Heat treatment, structure and properties of nonferrous alloys, American Society forMetals J. G. Kaufman, E.L.Rooy: Aluminium Alloys casting, ASM International 2005 ASM Spec,. Handbook, Coper and copper Alloys, ASM International 2001 ASM Spec. Handbook: Cast Irons, ASM International W. Callister: Materials science and engineering an introduction, John Wiley & Sons, Inc., USA,2007	

Evaluation method:	Mid-term assessment and evaluation: to check the follow-up of the lectures, you will be given an individual assignment after each lecture, which must be answered in writing by the time of the next lecture. A maximum of 1 mark will be awarded for each answer. A total of 6 points is required by the end of the semester. If you do not have 6 points by the end of the semester, you will have to solve a number of problems equal to three times the number of missing answers. The oral examination may be taken during the pre-examination period. The value of the mark depends on the performance on the day.

Course Description		
Course title:	Automatization	
Neptun code:	MAKÖNT121-22-B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	1l + 2p	
Name and position of lecturer:	Janos Erdelyi, Phd associate professor	
Contact of lecturer:	janos.erdelyi@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	The task of the Foundry Automation Knowledge course is to familiarize students with the basic concepts of automation technology and to demonstrate their application through foundry examples. The structure and principle of control and regulation, showing their operation through practical examples. Comparison of control and regulation. Construction of pneumatic systems, practical examples. Construction of hydraulic systems, practical examples. The basic structure of the PLC, practical examples. Basics of measurement technology, sensors, measurement practices. The aim of the training is for the materials engineering students to learn about the automation solutions used in casting technologies. They should be able to recognize the given elements and systems in the given place, as well as be able to plan automation processes and diagnose errors.	
Course structure:	**Week**	**Topic**
	1.	Basic concepts and scope of automation. The control and controlled system.
	2.	Effect, effect chain, signal carriers, signs. Grouping and types of signs. Concepts related to impact design.
	3.	Block diagram, elements and operation of the control. Practical examples of casting controls.
	4.	Block diagram, elements and operation of the regulation. Practical examples of casting regulations.
	5.	Comparison of control and regulation, significant differences and similarities. Practical examples.
	6.	Division of automation. Division of regulation, regulatory bodies, regulations.
	7.	Sensors. Perception and measurement of physical characteristics, types, practical examples.
	8.	Structure, elements and operation of pneumatic systems. Standard symbols, circuit diagrams.
	9.	Structure, elements and operation of hydraulic systems. Standard symbols, circuit diagrams.
	10.	PLC structure, operation, types. Programming options, programming, practical examples
	11.	Basics of measurement technology, measurement amplifiers, measurement technology practice.
	12.	Test
	13.	
Required readings:		
Recommended readings:	Richard L. Shell - Ernest L. Hall: Handbook of Industrial Automation, Marcel Dekker, 2000. Srinivas Medida: Pocket Guide on Industrial Automation For Engineers, IDC Technologies, 2007. (https://www.pacontrol.com/download/Industrial-Automation-Pocket-Guide.pdf	
Evaluation method:	test (evaluation on a five-point scale: 1-5)	

Course Description	
Course title:	Engineering communication
Neptun code:	MAKMET124B
Type (core, specialization, optional, dissertation, other):	core
Lecture/ Seminar (practical); hours per week:	2l + 2p
Name and position of lecturer:	Dr. Béla TÖRÖK, associate professor
Contact of lecturer:	bela.torok@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	7/autumn
Number of credits:	2
Requirements (exam/practical mark/signature/report, essay):	practical mark
Course objectives (50-100 words):	The basic task of the course is to develop students' communication skills and to familiarise them with the functions and forms of communication used in engineering and business practice. The course will provide a complex knowledge of general and specific (engineering and business) communication requirements, characteristics and functions in a generalised formulation and through the presentation of model examples. The course aims to equip students not only with professional knowledge, but also with the ability to express, convey and apply it in appropriate situations. Be aware of the basic ethical, strategic and communicative situations, verbal and visual expectations of business, the basic rules of business and workplace protocol and the specific rules of engineering culture. They should be able to use communication tools effectively, to express themselves in motivational situations, conflict management or advocacy situations.

Course structure:	**Week**	**Topic**
	1.	Concept, functions, types and general model of communication. Processes, dynamics and channels of direct human communication.
	2.	Organisational communication. Types and basic rules of oral and written business communication.
	3.	Prescriptive functions of engineering communication: product and process documentation, product design, technical specifications, process specifications, instructions for use, etc.
	4.	Mediating and fact-finding functions of engineering communication: discussion, conducting meetings, minutes. Archiving aspects. Written communication: business letter, e-mail, request, order, contract.
	5.	Basic situations in business communication. Negotiation strategies and tactics. Proposals, argumentation, persuasion, resistance management. Communication with partners, clients, customers, customers, official organisations.
	6.	Concepts and principles of business ethics. Ethics and protocol in domestic and international business. Effects of behavioural culture, appearance and non-verbal communication.
	7.	Basic and specific aspects of verbal communication. Characteristics and styles of speech. Questioning techniques, active listening, accurate understanding. Appropriate and topical expression, vocabulary, intelligibility.
	8.	Basic concepts of visual communication. Visual language in reception and creation.
	9.	Aspects of making and presenting a professional presentation. Presentation techniques. Preparing professional and scientific communications and publications.
	10.	Personality traits and basic leadership theories. The role of communication in motivation. Conflict management and conflict management.
	11.	Communication at the university. Key learning competences and their development with a focus on communication in the university's master's and doctoral programmes.
	12.	Writing a multiple-choice test .
	13.	Presentation of the homework assignments (PPT for a case study).

Required readings:	David Ingre, Robert Basil: Engineering Communication: A Practical Guide to Workplace Communications for Engineers. Cengage Learning, 2016. ISBN 978-1-305-63510-4 Robert Irish, Peter Weiss: Engineering Communication: From Principles to Practice. Oxford University Press, 2013. ISBN 978-0-195-44692-0
Recommended readings:	Charles W. Knisely, Karin I. Knisely: Engineering Communication. Cengage Learning, 2015, ISBN 978-1-133-11470-3 Heather Silyn-Roberts: Professional Communications: A Handbook for Civil Engineers. American Society of Civil Engineers, 2004. ISBN 978-0-784-40732-5
Evaluation method:	Writing a multiple-choice test: 20 questions - 1 point/good answer + presentation of the homework assignment: 20 points = 40 points. Excellent: 35-40, Good: 30-34, Average: 25-29, Satisfactory: 21-24, Failed: 0-20.

Course Description		
Course title:	Conformity of Measurements	
Neptun code:	MAKFKT112-22-B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l + 3p	
Name and position of lecturer:	Dr. Mikó Tamás, senior research fellow	
Contact of lecturer:	tamas.miko@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	7/autumn	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	The main goal of the course is for students to become familiar with the uncertainty of basic measurements related to material testing. In the world of material science and engineering, the correct planning and execution of the measurements, as well as the processing and evaluation of the data obtained as a result, and finally the communication protocol, are of particular importance. The purpose of the "Conformity of measurements" subject is a thorough overview of the steps of this process, during which students develop the practical application of various material testing methods and expand their measurement knowledge.	
Course structure:	**Week**	**Topic**
	1.	Development and use of units of measure other than SI and Si.
	2.	Method of determining and communicating measurement results (mean, standard deviation, median, mode, variance, normal distribution, measurement uncertainty).
	3.	Content and form requirements of measurement reports.
	4.	Calibration and use of the most important engineering tools for length measurement (caliper, micrometer).
	5.	Calibration and use of analytical balances.
	6.	Density measurement using the geometric and Archimedes method.
	7.	Standard hardness measurement, calibration of hardness tester.
	8.	Presentation and calibration of the fine strain measuring devices of a tearing machine.
	9.	Carrying out a standard tensile test, evaluating tensile curves (methods of determining yield strength, Young's modulus).
	10.	Temperature measurement using different methods, making and calibrating thermocouples.
	11.	Determination of thermal expansion coefficients of metals using dilatometer measurements.
	12.	Measuring the electrical resistance of different metals.
	13.	substitution of practices

Required readings:	H. T. Castrup; W. G. Eicke; J. L. Hayes; A. Mark; R. E, Martin: J. L. Taylor Metrology —Calibration and Measurement Processes Guidelines, Jet Propulsion Laboratory California Institute of Technology, Pasadena, California 1994 Forbes, A.B.: Measurement uncertainty and optimized conformance assessment. Measurement 39. 2006.
Recommended readings:	H. T. Castrup; W. G. Eicke; J. L. Hayes; A. Mark; R. E, Martin: J. L. Taylor Metrology —Calibration and Measurement Processes Guidelines, Jet Propulsion Laboratory California Institute of Technology, Pasadena, California 1994 Forbes, A.B.: Measurement uncertainty and optimized conformance assessment. Measurement 39. 2006.
Evaluation method:	exam

Course Description		
Course title:	Energy storage	
Neptun code:	MAKETT293B	
Type (core, specialization, optional, dissertation, other):	core	
Lecture/ Seminar (practical); hours per week:	2l	
Name and position of lecturer:	Dr. Zsolt Dobó, senior research fellow	
Contact of lecturer:	zsolt.dobo@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	7/autumn	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The course intends to give an overview of various energy storage methods focusing on the theoretical background, storage properties and characteristics, implementation of different energy storages into systems, and practical considerations. Examples of the most up-to-date storage solutions are included along with possible and promising directions.	
Course structure:	**Week**	**Topic**
	1.	Introduction, classification, energy conversion, semester overview.
	2.	Batteries - Lithium ion batteries I. Introduction, working principle, characteristics, materials, cell setup.
	3.	Batteries - Lithium ion batteries II. BMS, interconnection, implementation, recycling, research trends.
	4.	Batteries - Other batteries. Overview of lead acid batteries, vanadium redox flow batteries, NaS batteries.
	5.	Capacitors - Theoretical background, setup, properties, utilization. Introduction of supercapacitors.
	6.	Pump hydro - Overview of pump hydro energy storage as the largest installed capacity energy storage solution worldwide.
	7.	Chemical energy storage I. - Hydrogen production methods, focus on green hydrogen, electrolysis, hydrogen properties and characteristics. Power-to-gas and power-to-liquid, power-to-X concepts.
	8.	Chemical energy storage II. - Conversion of hydrogen into various feedstocks.
	9.	Thermal energy storage - Sensible, latent, thermo-chemical. Heat exchangers. Phase-change materials.
	10.	Other energy storage methods.
	11.	Summary, comparison, integration, development.
	12.	Test
	13.	Retake test
Required readings:	Michael Sterner, Ingo Stadler: Handbook of Energy Storage: Demand, Technologies, Integration. Springer, 2019. ISBN 978-3-662-55503-3.	
Recommended readings:	Armin U. Schmiegel: Energystorage systems. Oxford University Press, 2023, ISBN 978–0–19–285800–9.	
Evaluation method:	Signiture upon successful test. Exam.	

Course Description

Course title:	Surface treatment and coatings	
Neptun code:	MAKFKT123B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Prof. Peter Baumli	
Contact of lecturer:	peter.baumli@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	4/spring	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	practical mark	
Course objectives (50-100 words):	The aim of the course is to introduce students to the fundamental methods and objectives of surface treatment and coating formation. In addition to the technology itself, students will gain insight into coating defects and explore the problems they can cause.	
Course structure:	**Week**	**Topic**
	1.	General Introduction to Coatings
	2.	Coatings Formed via Chemical Reduction from Aqueous Solutions I
	3.	Coatings Formed via Chemical Reduction from Aqueous Solutions II
	4.	Coatings Formed via Electrochemical Processes I
	5.	Coatings Formed via Electrochemical Processes II
	6.	Gas-Phase Coating Methods, PVD
	7.	Gas-Phase Coating Methods, CVD, ALD
	8.	Paints and Varnishes
	9.	Spraying Methods
	10.	Hot-Dip Coating Methods
	11.	Thermal Surface Treatment Processes I.
	12.	Thermal Surface Treatment Processes II.
	13.	Thermochemical Surface Treatment Processes
Required readings:	Handbook of Surface Treatments and Coatings, ISBN 10: 0791801950 ISBN 13: 9780791801956, American Society of Mechanical Engineers, 2003	
Recommended readings:	Paint and Surface Coatings Theory and Practice, edit: R. Lambourne and T. A. Strivens, Elsevier Science	
Evaluation method:	The students prepare a semester project work. After the submission of the semester work, the teacher evaluates it. Accepted the semester work, the students can start the Oral examination.	

Course Description	
Course title:	Form and Core Making
Neptun code:	MAKÖNT124B
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)
Lecture/ Seminar (practical); hours per week:	2l + 1p
Name and position of lecturer:	László Varga, Phd, Associate Professor
Contact of lecturer:	laszlo.varga1@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-6	4/spring
Number of credits:	3
Requirements (exam/practical mark/signature/report, essay):	exam

Course objectives (50-100 words):	The students get to know the foundry molding materials, their important properties, test and application methods. The introductory part of the subject summarizes the casting production methods, so that the individual typical molding technology methods can be ordered next to it. He then discusses it mineralogical, granulometric and main thermal properties of foundry sands, as well as the molding and general characteristics for core sand mixtures. They become familiar with the preparation of each molding mixture, its properties and what can be ordered with it molding and core preparation methods, as well as the possibilities of reuse. In the practical lessons, students learn the basic methods of testing and applying molding and core sand mixtures.	
Course structure:	**Week**	**Topic**
	1.	1. Industrial use of castings. Summary of casting production methods (permanent molds, perishable molds). The process of molding and casting. Mold making procedures. Requirements for molding procedures. Mineralogical and thermal characteristics of foundry sands. Requirements for molding materials. Fire resistance, expansion. Types of sand (quartz, zircon, chromite, olivine, artificial). Basic properties of quartz sand.
	2.	2. Granulometric characteristics of foundry sands. Porosity of foundry sand mixes. Test methods. Compaction of molding sand mixtures, gas permeability. Summary of factors influencing the mechanical strength of molds. Inorganic binders, mineralogical properties of bentonite. Requirements for bentonite from a casting point of view.
	3.	3. Composition and production of bentonite molding mixtures. Its most important properties and their measurement methods. Correlations between the quality of the molding mixture and the examined parameters. Reprocessing process, update and mold making.
	4.	4. Properties of water-glass molding mixtures. Bond formation between sand grains, condensation reaction (sol-gel state). Curing possibilities of the water glass-based mold. The water glass module and its important parameters. Effects of the module on the properties of the molding compound. Form and core preparation.
	5.	5. Wax melting technology, precision casting. The process of casting production. Refractory materials for coatings. Inspection of coatings, inspection of mold shell. Ceramic shaping (Shaw process).
	6.	6. Summary of resin-bonded molding and core mixes (cold-setting, hot-setting). Requirements for seeds.
	7.	7. The mechanism of formation of organic bonds. Advantages and disadvantages of using different resins.
	8.	8. Properties and testing of resin-bonded molding compounds. Curing characteristic.
	9.	9. Presentation of hot setting procedures. Hot-Box, Warm-Box and Croning. Shell molding materials, production of resin-coated sand. The seed making process.
	10.	10. Summary of gas flooding procedures. Cold-Box, Resol Methylformate, Resol-CO2, Hardox procedures.
	11.	11. Sand regeneration and recycling. They are caused by scrap from the molding material.
	12.	
	13.	
Required readings:	1. Dr. Jónás Pál, Dr. Tóth Levente: Fomázóanyagok vizsgálata és öntödei gépek. 2. VDG Taschenbücher Formstoffe und Formverfahren in der Giessereitechnik, Giesserei-Verlag GmbH Düsseldorf 1983 3. Bakó K. - Sándor J. - Szabó Zs. - Szijj Z.: Öntvények gyártástechnológiája, Műszaki Könyvkiadó Bp. 1986. 4. Praxishandbuch bentonitgebundener Formstoff. Werner Tilch, Hartmut Polzin, Michael Franke. Fachverlag Schiele & Schön; Auflage: 1 (10. Juni 2015), ISBN-10: 379490897X 5. Anorganische Binder - zur Form- und Kernherstellun	
Recommended readings:	1. Öntészeti kézikönyv, Műszaki Könyvkiadó Bp. l985. 2. BKL Kohászat témához kapcsolódó cikkei, http://www.ombkenet.hu/index.php/bkl-kohaszat 3. A Giesserei Rundschau cikkei: http://www.voeg.at/web/archiv.html 4. ASM Handbook Volume 15: Casting,ASM International, 2008, ISBN: 978-0-87170-711-	
Evaluation method:	The preparation of a semester assignment is the preparation of a literature summary related to the subject material. Using domestic and international literature, at least 10 A4 pages.	

Course Description		
Course title:	Metallurgy of light-metal alloys	
Neptun code:	MAKMET121-22-B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 1p	
Name and position of lecturer:	Dr. Tamas Kekesi, professor	
Contact of lecturer:	tamas.kekesi@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	4/spring	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The fundamental metallurgical processes and technologies to produce and to purify light metal alloys and light metals (mainly aluminium) that are most significant for industrial applications. Recycling alloying and casting technologies are also covered. The types, properties and production of aluminium grades and alloys are systematically discussed. The metallurgy of magnesium and titanium, as well as lithim are discussed. A special outlook is made to lithium recovery.	
Course structure:	**Week**	**Topic**
	1.	The properties of the structural light metals (Al, Mg and Ti). The possible physico-chemical methods of extraction.
	2.	The characterization of the light metal raw materials (Primary and secondary resources).
	3.	Processing of light metal oxides. The main steps of the Bayer technology.
	4.	Alumina production. Special properties. Light metal compounds.
	5.	Electrolytic reduction of light metal compounds. Aluminium electrolysis.
	6.	Aluminium refining in the industry. Special purification.
	7.	The precessing of aluminium alloy scrap. Melting, slag formation, metal losses and recovery.
	8.	Aluminium alloy melt refining, continuous casting.
	9.	Aluminium alloy purity analysis. Alloy types and applications.
	10.	The extraction and refining of magnesium.
	11.	The metallurgy and application of titanium
	12.	The raw materials and the compound products of lithium.
	13.	Li-ion batteries and their metallurgical recycling.
Required readings:	T. Kékesi: Fundamentals of Chemical Metallurgy [PDF], (2018) 153 p. ISBN 978-963-358-198-8 http://193.6.1.94:9080/?docId=33180 Kékesi, T.: Primer és szekunder alumíniummetallurgia [PDF], (2019) 279 p. ISBN 978-963-358-199-5. http://193.6.1.94:9080/?docId=33176 Kékesi T., Illés I. B.: A magnézium és a titán előállítása [PDF], (2019) 70 p. ISBN 978-963-358-201-5 http://193.6.1.94:9080/?docId=33178	
Recommended readings:	Schlesinger, E.,M.: Aluminum Recycling, CRC Press, (2017). ISBN 9781138073043. I. B. Illés and T. Kékesi, “Enhancing the Metal Yield of the Rotary Converter Melting of Aluminium Drosses with Simple Sodiumchloride:Thermodynamic and Kinetic Considerations,” Hungarian Materials and Chemical Sciences and Engineering., 47, 1, pp. 72–78, 2023. H. Balázs, N. Gábor, and K. Tamás, “Salt Recovery from the Hot Treated Aluminium Melting Dross Residue,” Hungarian Materials andChemical Sciences and Engineering, 47, 1, pp. 128–137, 2023.	
Evaluation method:	Oral exam	

Course Description		
Course title:	Iron and Steel Metallurgy	
Neptun code:	MAKMET256B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 1p	
Name and position of lecturer:	Dr. Béla TÖRÖK, associate professor; Dr. Gábor SZABÓ, senior research fellow, Dr. Róbert MÓGER, college associate professor	
Contact of lecturer:	bela.torok@uni-miskolc.hu, gabor.szabo@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	4/spring	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The basic aim of the course is to familiarise students with iron and steel production technologies used in industry. Detailed objectives are to briefly describe the theoretical and practical aspects of the production of ferrous metals by reduction, as well as the industrial technologies currently used, focusing on the major international production bases.	
Course structure:	**Week**	**Topic**
	1.	Introduction. Literature. Historical overview.
	2.	Methods and technologies of ore preparation. Main physical, chemical and metallurgical properties of iron ore sinters and pellets.
	3.	Parts, basic equipment and main characteristics of a blast furnace. Basic technological and metallurgical processes of pig iron production.
	4.	Indirect and direct reduction of iron oxides. Metallurgical, energetic and reaction kinetic characteristics of reduction with carbon monoxide, hydrogen and carbon.
	5.	Slag systems in iron metallurgy. The role of coke consumption and the productivity of the blast furnace.
	6.	First test. Phases of steelmaking, main thermodynamic and reaction kinetic relationships. Characterisation and composition of the metallic melt phase.
	7.	Slags from steel production. Slag phase characterisation, slag diagrams. Slag composition calculations.
	8.	Reactions of readily oxidizable elements and other alloying elements.
	9.	Deoxidation of steels. Different deoxidation methods. Calculation of the amount of deoxidising agent.
	10.	Sulphur and phosphorus content of steel. Dissolution of gases in steel, degassing. Inclusions in steel and their effects. Removal of contaminants.
	11.	Raw materials and equipment for BOF steelmaking. BOF steelmaking processes.
	12.	Calculations for BOF steelmaking: heat balance and material balance, alloying material requirements, determination of dissolved gas.
	13.	Second test and test rewrite if it necessary.
Required readings:	E.T. Turkdogan – R.J. Fruehan: Fundamentals of Iron and Steelmaking. Material Science, Engineering, 1998. (pdf) P. Cavaliere (ed.): Ironmaking and Steelmaking Processes - Efficient Technologies for Greenhouse Emission Abatement, Springer, 2019 (pdf)	
Recommended readings:	D. H. Wakelin (ed.): The Making, Shaping and Treating of Steel (iron Making) ASIN : B011SKF61I (pdf) A. Ghosh - A. Chatterjee: Ironmaking and Steelmaking - Theory and Practice. Prentice-Hall of India Pvt.Ltd; 2008. ISBN-13:978-8120332898	

Evaluation method:	Writing two tests: 3-3 questions (marks:1-5). Written examination (marks:1-5): 1: the student is not familiar with the basic concepts, 2: the student is familiar with the basic concepts, but still has some major errors in more than 50% of the questions, 3: the student is familiar with the basic concepts, but has some minor errors in the practical application, and still has some errors in some of the specific cases, 4: the student has a good knowledge of the subject matter, knows the context, but does not yet have a broader perspective and the creativity to draw independent conclusions in numerous questions and cases, 5: the student has a good knowledge of the subject matter, knows and applies the context, is able to draw deeper conclusions. Final mark: 0.75*mark of the written examination + 0.25*average marks of the tests.

Course Description		
Course title:	Aluminium casting	
Neptun code:	MAKÖNT123B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Gábor Gyarmati, assistant lecturer	
Contact of lecturer:	gabor.gyarmati@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	5/autumn	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is to learn about the melting, melt treatment and casting technologies of aluminium alloys and to understand the processes involved in each technological step of aluminium metalcasting. The course aims to familiarise students with the parameters affecting the quality of aluminium castings, the causes of casting defects and ways of preventing them. Factors influencing the microstructure of aluminium alloy castings and thus the quality of castings are discussed.	
Course structure:	**Week**	**Topic**
	1.	Classification of aluminium alloys, alloying systems used as casting aluminium alloys, effects of alloying and impurity elements
	2.	Properties and application examples of the most common casting alloys
	3.	Melting technology of aluminium alloys, most commonly used furnace types, their operation, advantages and disadvantages of each furnace type. Ways of transporting liquid metal
	4.	Adjustment and control of the chemical composition of alloys, methods of controlling the amount of each alloying element
	5.	Factors influencing melt quality, dissolved hydrogen content and control of non-metallic inclusions. Non-metallic inclusion formation processes, with particular reference to oxide inclusions
	6.	Direct and indirect methods for quantitative analysis of dissolved hydrogen content. Quantification of non-metallic inclusions
	7.	Melt purification technologies, the physics and physical-chemistry of the technologies. Methods for degassing of liquid Al alloys. Types of fluxess used in melt treatment, their characteristic components and their effects. Types of filters and how they are used
	8.	The causes of the formation of porosity. The role of dissolved gas content, solidification shrinkage and oxide inclusions in the development of porosity. Feeding mechanisms and fundamentals of feeding technology for aluminium castings
	9.	Chemical grain refinement of aluminium alloys. Grain refinement mechanisms, types and properties of grain refining additives. Evaluation of the efficiency of grain refinement by thermal analysis and microstructural analysis. Effects of grain refinement on the properties of castings.
	10.	Modification of the Al-Si eutectic, the mechanism of modification and the microalloying elements used for modification. Characterisation of the degree of modification by thermal analysis and microstructural analysis.
	11.	Factors determining fluidity of liquid Al alloys. Fundamentals and correlations of filling system design of aluminium gravity castings.
	12.	Classification of typical casting defects, methods of detection and avoidance.

	13.	Heat treatment of aluminium castings
Required readings:	G. Sigworth: Best Practices in Aluminum Metalcasting. American Foundry Society, 2014.; J. E. Gruzleski, B. M. Closset: The Treatment of Liquid Aluminum-Silicon Alloys. The American Foundry Society Inc. Des Plaines, Illinois, 1990.	
Recommended readings:	J. Campbell: Complete Casting Handbook, Butterworth-Heinemann, 2015. F.C. Robles-Hernandez, J.M.H. Ramírez, R. Mackay: Al-Si Alloys. Springer. 2017. J. Campbell: Mini Casting Handbook. Aspect Design. 2018. J. Campbell: Concise Castings. American Foundry Society, 2010.	
Evaluation method:	Written test at the end of term-time, exam during examination period	

Course Description		
Course title:	Forging technologies and equipments	
Neptun code:	MAKFKT125B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Dr. Máté Szűcs	
Contact of lecturer:	mate.szucs@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	5/autumn	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is to introduce students to the technological steps of open-die and closed-die forging, as well as the most important aspects of die- and machine design. The subject also presents wire drawing and extrusion technology and the associated mechanical equipment. Within the framework of the subject, the students are given a mid-year task, in which they design a forged part, the dies and the forging technology.	
Course structure:	**Week**	**Topic**
	1.	open-die forging I.
	2.	open-die forging II.
	3.	open-die forging II.
	4.	closed-die forging I.
	5.	closed-die forging I.
	6.	closed-die forging II.
	7.	closed-die forging II.
	8.	Mechanical hammers and presses I.
	9.	Mechanical hammers and presses II.
	10.	Hydraulic presses
	11.	Drawing and extrusion
	12.	Drawing and extrusion
	13.	Machines of drawing and extrusion
Required readings:	A.Geleji: Forge Equipment Rolling Mills and Accessories	
Recommended readings:	Henry S. Valberg: Applied Metal forming,Taylan Altan, Gracious Ngaile, Gangshu Shen : Cold and Hot Forging Fundamentals and Applications	

Evaluation method:	The conditions for signing and obtaining a degree are the active participation in lectures and practical sessions, preparation of the mid-year task (at least at a sufficient level), and completing a written test with at least sufficient results.

Course Description		
Course title:	Secondary steel metallurgy and continuous casting	
Neptun code:	MAKMET123B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l	
Name and position of lecturer:	Dr. Róbert Móger, Associate Professor	
Contact of lecturer:	robert.moger@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	5/autumn	
Number of credits:	2	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The course aims to introduce students to the theoretical and practical aspects of secondary steel metallurgy and continuous casting processes. It covers various secondary metallurgical procedures and the industrial applications of continuous steel casting, with a focus on the Hungarian manufacturing industry.	
Course structure:	**Week**	**Topic**
	1.	Introduction, historical overview, safety regulations
	2.	Physical chemistry of primary processes
	3.	Electric arc furnace and its energy supply system
	4.	Presentation of electrode holder and moving structure
	5.	Charging systems, gas treatment
	6.	BAT requirements in steel production
	7.	Understanding the documentation of steel production equipment
	8.	Site practice in a steel scrap preparation plant
	9.	Passive and active ladle metallurgy procedures
	10.	Role of inclusions in steel quality
	11.	Traditional steel casting
	12.	Continuous steel casting, structure of the casting machine
	13.	Overview of casting defects
Required readings:	Kor, and Glaws, Ladle Refining and Vacuum Degassing. [https://studylib.net/download/8246142] Turkdogan, and Fruehan, Fundamentals of Iron and Steelmaking	
Recommended readings:		
Evaluation method:	During the semester, two written tests are required, and the final grade is calculated based on the exam and the test results: J = 0.75K + 0.25(1/2 Z1 + 1/2 Z2). A retest is mandatory in case of a failed test.	

Course Description	
Course title:	Pressure and die casting
Neptun code:	MAKÖNT125B
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)
Lecture/ Seminar (practical); hours per week:	2l + 1p
Name and position of lecturer:	Janos Erdelyi, Phd associate professor
Contact of lecturer:	janos.erdelyi@uni-miskolc.hu

Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The task of the subject of pressure and mold casting is to familiarize students with the technologies and their equipment in the subject area. They learn the relevant theoretical foundations of casting, and then apply them to model the operation of the technological process. Real casting exercises are carried out on a pressure casting machine, and the material structure and mechanical properties of the resulting castings are evaluated. The aim of the training is for the graduated materials engineering student to be able to perform independent engineering activities in the subject area, to be able to calculate/measure technology, and then operate equipment and produce castings based on that.	
Course structure:	**Week**	**Topic**
	1.	Basics of pressure and mold casting, description of technology, typical castings and their use
	2.	Presentation of pressure casting techniques and their comparison
	3.	Horizontal cold chamber pressure casting equipment and their operation
	4.	Closing units of pressure molding machines, pressure molding tools
	5.	Casting units of pressure casting machines, their operation, descriptive relationships
	6.	Presentation of pressure casting technology, casting technical calculations, sizing
	7.	Description of the requirements of the six-month technology complex task, release of casting bouquets
	8.	In the framework of a practical lesson, the necessary geometric and weight measurements on the received castings, CAD drawing
	9.	Operation of the pressure casting machine in the workshop, casting experiments, analyses
	10.	Vacuum technology, separation equipment, cooling-heating equipment
	11.	Requirements for castings, casting defects and their causes
	12.	Presentation of semester assignment and test
	13.	Test
Required readings:	Michael L. Cox: PQ2 Machine Power and Die Compatibility, North American Die Casting Assoc. 2015. NADCA: Standards for High Integrity and Structural Die Casting Process, NADCA 2015.	
Recommended readings:	Edward J. Vinarcik: High Integrity Die Casting Processes, John Wiley & Sons Inc, 2003Verband Deutscher Druckgießereien: Druckguss aus NE-Metallen, VDD 2008	
Evaluation method:	Attending lectures and exercises (maximum 2 absences), solving a six-month technological complex task, creating a protocol based on the results obtained (evaluation on a five-point scale: 1-5) test (assessment on a five-point scale: 1-5) the subject can be signed by the student who completes the semester assignment and the mid-semester homework at least sufficiently completed at level (2) and was absent from the course a maximum of two times. exam: written and oral (assessment on a five-point scale: 1-5, answering five questions issued, as many gives a good answer, the student has that many points, so 2 good answers are required for the colloquium to fulfill	
Evaluation method:	Attending lectures and exercises (maximum 2 absences), solving a six-month technological complex task, creating a protocol based on the results obtained (evaluation on a five-point scale: 1-5) test (assessment on a five-point scale: 1-5) the subject can be signed by the student who completes the semester assignment and the mid-semester homework at least sufficiently completed at level (2) and was absent from the course a maximum of two times. exam: written and oral (assessment on a five-point scale: 1-5, answering five questions issued, as many gives a good answer, the student has that many points, so 2 good answers are required for the colloquium to fulfill	
Course Description		
Course title:	Heat treatment of Ferrous alloys	
Neptun code:	MAKFKT126B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	Dr. Zsolt Veres, associate professor	
Contact of lecturer:	zsolt.veres@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	

Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The aim of the course is the presentation of the metallurgical physical basics of the heat treatment methods. The students will learn the plan the worldwide heat treating technologies. They will learn the conventional and modern technology of the most important heat treating technologies.	
Course structure:	**Week**	**Topic**
	1.	1.Types and classification of ferrous alloys
	2.	2.Physical and thermal properties of steels
	3.	3.Types of heat transfer, cooling mediums
	4.	4.Solid state transformations in ferrous alloys
	5.	5.Stress in steels, stress relieving
	6.	6.Annealing, homogenization, Recrystallization, austenitization
	7.	7.Temper-hardening
	8.	8.Normalizing, austempering, martempering
	9.	9.Surface hardening
	10.	10.Thermochemical treatments
	11.	11.Heat treatment installation
	12.	12.Heat treating of cast iron
	13.	13.Heat treating of cast iron
Required readings:	•R. Davis, ASM Handbook, Volume 4, Heat treating, ASM International, 1991 •G. Krauss, Principles of heat treatment of steel, ASM, Ohio, 1988, ISBN: 0-87170-100-6	
Recommended readings:	•H. Chandler, Heat treater's guide, ASM, ISBN: 0-87-170-565-6	
Evaluation method:	Report about the practical lectures, Oral exam	

Course Description		
Course title:	Heat treatment of non-ferrous and light metals	
Neptun code:	MAKFKT127B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 2p	
Name and position of lecturer:	prof. Peter Barkóczy	
Contact of lecturer:	peter.barkoczy@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	4	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The processing technology of aluminium alloys and related heat treatment processes are presented in the subject. Such as: casted slab homogenization, annealing process, precipitation hardening. Participants get acquainted with the effects of different alloys and the properties of alloys. The properties of copper alloys and specific heat treatment technologies of copper alloys are also presented. Separately highlighted are brass and aluminum bronzes.	
Course structure:	**Week**	**Topic**
	1.	Physical metallurgy of non-ferrous metals, states, properies
	2.	Microstructure - properties relationship, typical microstructures of aluminum alloys

	3.	Aluminum alloys, properties of the alloys, processing technology
	4.	As cast state, homogenization heat treatment, AL-Mn alloys
	5.	Plastic deformation, annealing, Al-Mg alloys
	6.	Precipitation, dissolution, ageing heat treatement, Al-Mg-Si, Al-Cu, Al-Zn alloys
	7.	Typical microstructure of coppers and copper alloys
	8.	Copper alloys, properties of the alloys, processing technology
	9.	Brasses, bronzes, annealing of copper alloys
	10.	Aluminum bronzes, heat treatment of aluminium bronzes
	11.	Other copper alloys and its heat treatement
	12.	High temeprature corrosion
	13.	Case studies
Required readings:	J. R. Davis: ASM Specialty Handbook, Copper and Copper Alloys, ASM international, 2001 John Humphreys, Gregory S. Rohrer, Anthony Rollett: Recrystallization and Related, Annealing Phenomena, Elsevire, 2017, Harry Chandler: Heat Treater's Guide, Practices and Procedures of Non-ferrous Alloys, ASM-International, 1996	
Recommended readings:	David J. Young: High Temperature Oxidation and Corrosion of Metals, Elsevier, 2016 D.G. Eskin: Physical Metallurgy of Direct Chill Casting of Aluminum Alloys, CRC Press, 2008	
Evaluation method:	Exam at the end of the semester	

Course Description		
Course title:	Iron casting	
Neptun code:	MAKÖNT127B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 1p	
Name and position of lecturer:	Laszló Varga, Phd, Associate Professor	
Contact of lecturer:	laszlo.varga1@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The subject material is part of the core material of casting education. The students within the course learn about tempered and nodular cast iron and austempered nodular cast iron properties, chemical composition, method of production and special heat treatment technologies.	
Course structure:	**Week**	**Topic**
	1.	Affecting the spherical crystallization of graphite factors.
	2.	Spherical graphite treated with magnesium fabric structure of cast irons.
	3.	Determination of the amount of Mg. THE methods and conditions of spheroid treatment.
	4.	Nodular cast irons are mechanical properties in the cast and heat-treated state.
	5.	Austempered nodular graphite cast iron production, properties.
	6.	Transitional nodular graphite cast irons production, tissue structure.
	7.	Transitional nodular graphite cast irons mechanical properties, areas of use.
	8.	Theoretical for the production of malleable cast iron aspects. Manufacturing methods.
	9.	The white and black broken malleable cast irons heat treatment, strength properties, use areas.

	10.	Production of weldable malleable cast iron.
	11.	Production of wear-resistant iron castings.
	12.	The effect of alloying elements is emerging to tissue structure. Bark cylinders. Alloyed types of cast iron, their properties
	13.	Test
Required readings:	Eisenwerkstoffe - Stahl und Gusseisen Berns, Hans; Theisen, Werner Springer Berlin , 2008, ISBN: 9783540799559 John Campbell: Castings, University of Birmingham, 2000 John R. Brown et al.: Foseco Ferrous Foundryman's Handbook, Butterworth & Heinemann, 2000	
Recommended readings:	Campbell, John: Castings (The new metallurgy of cast metals, second edition) http://books.google.com/books?id=DhRrRzavMfwC&printsec=frontcover&dq=castings+campbell&hl=de& sig=ACfU3U2ry3mnWLzmLgl0MTCGizeU6HY-Og Gusseisen mit Kugelgraphit Herstellung, Eigenschaften, Anwendung http://www.kug.bdguss.de/fileadmin/content/Publikationen-Normen-Richtlinien/buecher/GJS.pdf Verschleißbeständige weiße Gusseisenwerkstoffe Eigenschaften und Anwendung http://www.kug.bdguss.de/fileadmin/content/Publikationen-Normen-Richtlinien/buecher/GTW.pdf Konstruieren und Gießen Temperguss, ein duktiler Gusseisenwerkstoff http://www.kug.bdguss.de/fileadmin/content/Publikationen-Normen-Richtlinien/Temperguss.pdf Weißer Temperguss Dünnwandige und komplexe Gussteile http://www.kug.bdguss.de/fileadmin/content/Publikationen-Normen-Richtlinien/GTW Bewaehrt__wirtschaftl._u._leistungsstark.pd	
Evaluation method:	The preparation of a semester assignment is the preparation of a literature summary related to the subject material. Using domestic and international literature, at least 10 A4 pages.	

Course Description		
Course title:	Rolling	
Neptun code:	MAKMET120-22-B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	2l + 1p	
Name and position of lecturer:	Dr. Gábor Szabó, Senior Research Fellow	
Contact of lecturer:	gabor.szabo@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	6/spring	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	exam	
Course objectives (50-100 words):	The main objective of this course is to introduce students to the industrial rolling technologies. It provides an overview of the rolling of ferrous and light metals, the theoretical and practical background of rolling, and the current industrial technologies with a focus on Hungarian manufacturing plants.	
Course structure:	**Week**	**Topic**
	1.	Introduction, course objectives, historical overview
	2.	Characteristics of the forming process during rolling
	3.	Rolled products and rolling mills
	4.	Forming strength and resistance
	5.	Rolling technology of profiles

	6.	Design of stretching groove sequences
	7.	Basic concepts of flat product rolling
	8.	Temperature conditions in the rolling gap
	9.	Hot rolling of flat products
	10.	Rolling of heavy plates
	11.	Cooling of rolled flat products
	12.	Semi-continuous casting of aluminum alloys
	13.	Cold rolling of aluminum alloys
Required readings:	J.G. Lenard: Primer on Flat Rolling, Elsevier, 2007	
Recommended readings:		
Evaluation method:	During the semester, two written tests are required, and the final grade is calculated based on the exam and the test results: J = 0.75K + 0.25(1/2 Z1 + 1/2 Z2). A retest is mandatory in case of a failed test.	

Course Description		
Course title:	Industrial Case Studies	
Neptun code:	MAKFKT118-22-B	
Type (core, specialization, optional, dissertation, other):	specialization (metal technologies)	
Lecture/ Seminar (practical); hours per week:	3p	
Name and position of lecturer:	Prof. Dr. Valeria Mertinger	
Contact of lecturer:	valeria.mertinger@uni-miskolc.hu	
Prerequisite course(s):		
Language of the course:	English	
Suggested semester: autumn /spring, 1-6	7/autumn	
Number of credits:	3	
Requirements (exam/practical mark/signature/report, essay):	report	
Course objectives (50-100 words):	The course introduces the methodology of fault finding and the possibilities offered by each testing procedure by working through specific cases related to materials testing. During the course of the semester, a problem will be processed and synthesized in a 3-hour schedule. Each problem will have a different lecturer and typically a different methodology. The exercise specifically develops problem-solving skills	
Course structure:	**Week**	**Topic**
	1.	Case study 1
	2.	Case study2
	3.	Case study 3
	4.	Case study 4
	5.	Case study 5
	6.	Case study 6
	7.	Case study 7
	8.	Case study 8
	9.	Case study 9
	10.	Case study 10
	11.	Case study 11
	12.	
	13.	

Required readings:	ASM Spec,. Handbook, Aluminium and Aluminium Alloys, ASM International 1996[1] Otsuka Shape Memory Materials, Cambridge University Press, 1998 Krauss Principles of Heat treatment of Steel Askeland: The science and engineering of materials, PWS Publishing Company, 1989 W.D. Callister Materials science and engineering an introduction, John Wiley&Sons 2007 Van Vlack: Materials for engineering, Addison Wesley Publishing Company, 1982 Van Vlack: Elements of Materials Science and Engineering, Addison Wesley Publishing Company, 1982
Recommended readings:	Wiedemann: Structural materials, Open University, 1990 Van Vlack: Materials for engineering, Addison Wesley Publishing Company, 1982 C.R. Brooks: Heat treatment, structure and properties of nonferrous alloys, American Society forMetals J. G. Kaufman, E.L.Rooy: Aluminium Alloys casting, ASM International 2005 ASM Spec,. Handbook, Coper and copper Alloys, ASM International 2001 ASM Spec. Handbook: Cast Irons, ASM International W. Callister: Materials science and engineering an introduction, John Wiley & Sons, Inc., USA,2007
Evaluation method:	Mid-term examination and assessment:test on the exercises in the last week of the semester and the oral presentation of the task.