Department: Materials and Metallurgy- WINTER SEMESTER

No.	Course	Description of course	Level of studies	Hours				ECTS	Lecturer	Completely in English	Consultations in English
				Lectures	Seminars	Practice	Project work				
1	THERMODYNAMIC OF MATERIALS 1	The main objectives of this course are to teach students the thermodynamic laws and properties that the engineer of metallurgy and materials necessary for the understanding of the physico-chemical processes in materials and manufacturing technologies of these. Competencies: Students acquire thermodynamic laws, basic thermodynamics of liquid and solid solutions, chemical and phase equilibria in materials, fundamentals of kinetics and electrochemistry. All explanations are combined with a lot of calculation, enabling a better understanding of the processes in materials.	B.Sc.	45		30		5	prof.dr. Jožef Medved	depends on number of students	in case of small number of students
2	THERMODYNAMIC PRACTICUM (Only together with Thermodznamics of Materials 1)	Objective: Thermodynamic practicum is an upgrade ITEM Thermodynamics of materials. Student wins experimental techniques and evaluation of the results of basic thermodynamic methods of investigation and process engineering of non-ferrous metals. Competencies: Students in the practicum win the most important laboratory and "in-situ" methods of investigation of thermodynamics and kinetics of materials and evaluating the results. Students learn the basics of process engineering, non-ferrous metals.	B.Sc.	15		60		5	izr.prof.dr. Maja Vončina	depends on number of students	in case of small number of students
3	Heat treatment	The main procedure in making and processing metal materials is heat treatment of steels and alloys of non-ferrous metals. A controlled process of heat treatment leads to the formation of microstructures that define mechanical and technological properties of semi-products and final products. The goal of the course is to acquire theoretical foundations of structural changes occurring in the structure and microstructure of metals and alloys and transferring the knowledge into practice. Students will be able to autonomously plan and conduct heat treatment processes for various metal materials.	B.Sc. Metallurgical technology, Girst cycle Higher professional programme, year 3, semester 5	45		30		5	prof. dr. Aleš Nagode	yes	
4	Failure Analysis	Mechanisms of failures and damages formation. The most frequent mechanisms of damages formation: fracture, brittle fracture, wear, fatigue, thermal fatigue, corrosion fatigue, stress corrosion, ... Study of residual stresses. Identification of failures and damages. Analyses. Examination methods. Physical methods: mechanical testing, metallographic examination methods, chemical analyses, corrosion tests. Non-destructive testing methods: optical examination methods, replicas methods, examinations by penetrants, radiography, neutronography, magnetic examination, ultrasonic examination. Failures at manufacturing and exploitation - examples. Study of cases of damages and machines breaking. Modeling. Numerical simulations. Standards. Rules. Patents. Working and preparation of exspertises, reports and expert elaborates. Methodology, requirements and rules of work and preparation of expert elaborates for courts, insurance companies and other clients. Presentations. Project work. Individual preparation of expertise or expert work.	B.Sc. Metallurgy and Materials Engineering – Second cycle university level, year 2	40		20	60	4	Borut Kosec, prof. dr. Ale	Yes	
5	Physical metallurgy of steel	The course covers topics on physical and chemical properties of iron, crystal structure, allotropy, measurements of temperature in phase transitions, diffusion, alloy systems of Fe- C and other elements, phase transformation in Fe-C system, impact of alloying elements on the constitution of phase diagrams and the course of transformation, heat treatment, mechanical processing and surface hardening.	B.Sc. Materials Engineering – First cycle university level, year 3, semester 5	45		30		5	prof. dr. Aleš Nagode	yes	
6	Foundry	Basics of foundry engineering with explanation of different casting technologies, used materials and casting alloys. Solidification of alloys and casting defects. Moulding technology by sand casting and preparation of sand casting technology by theoretical calculations. Experimentqal confirmation of tecnology.	B.Sc. Materials Engineering – First cycle university level, year 3, semester 5	45	0	30	0	5	prof. dr. Primož Mrvar	Yes	in case of small number of students
7	Manufacturing technologies - Casting	Basics of foundry engineering with explanation of different casting technologies, used materials and casting alloys. Solidification of alloys and casting defects. Moulding technology by sand casting and preparation of sand casting technology by theoretical calculations. Experimentqal confirmation of tecnology.	B.Sc. Metallurgical technology, Girst cycle Higher professional programme, year 3, semester 5	45	0	30	0	5	prof. dr. Primož Mrvar	Yes	in case of small number of students

M.Sc. Lectures WINTER SEMESTER											
1	ALUMINIUM TECHNOLOGY	Aluminium is beside iron the second technically most useful metal. The properties of aluminium and its alloys like: small specific density, high strength, an advantageous relationship between strength and specific density, electrical and thermical conductivity, excellent formability, corrosion resistance and a simple and cheap recycling – enable its application in the all technically important sectors like: transport, building, construction, machinery, electrical, packaging, and consumer durable objects. Because of the increasing use and the constant improvements of the properties and manufacturing processes there appears, like at iron, a need to a deeper treatment of the topics in the research of aluminium as an independent subject. In the frame of this subject the student will get the knowledge about properties of aluminium materials in details and about the processes from the production to finalization and its application. The post-graduate bachelors of this field will have the possibility to get the employment in the firms producing and working aluminium, in the foundries in the metal-working industry and scientific institution.	M.Sc.	45	10	30		6	prof.dr. Jožef Medved, prof.dr. Aleš Nagode	depends on number of students	in case of small number of students
2	THERMODYNAMIC OF MATERIALS 2	The basis of the course is to teach the student basics of the thermodynamics in liquid and solid solutions, chemistry and phase equilibrium in materials, thermodynamics and kinetics of processes in solutions, that enables better understanding of processes in the materials. The students will learn about the thermodynamic basics of the phase diagrams, kinetics and diffusion and also chemistry. The lectures are complemented with seminar work, simulations and project work of planning, manufacturing and thermodynamic characterization of the materials.	M.Sc.	45	15		15	6	prof.dr. Jožef Medved	depends on number of students	in case of small number of students
3	Aluminium technologies	Aluminium is, after iron, the second most useful metal technically speaking. The properties of aluminium and its alloys like: small specific density, high strength, an advantageous relationship between strength and specific density, electrical and thermical conductivity, excellent formability, corrosion resistance and simple and cheap recycling – enable its application in all technically important sectors like: transport, building, construction, machinery, electrical, packaging and consumer durable objects. Because of the increasing use and the constant improvements to the properties and manufacturing processes, there appears, like with iron, the need for deeper treatment of the topics in the research of aluminium as an independent subject. In the framework of this course, students will obtain knowledge about properties of aluminium materials in detail and about the processes from production to finalisation and application. Post-graduate bachelors of this field will have the possibility to gain employment in firms producing and working aluminium, in foundries in the metal-working industry and in scientific institutions.	M.Sc. Metallurgy and Materials Engineering – Second cycle university level, year 2	45	10	30	5	6	prof. dr. Jožef Medved, prof. dr. Aleš Nagode		yes (part of Aleš Nagode)
4	Industrial Ecology and Energetics	General definitions. Environment. Natural sources. Environmental protection (ground, water and air protection, and noise protection). Emissions / imissions. Emissions types and quantity. Emissions quantity measurements. Measures and possibilities for emissions reduction. Pollution control. Monitoring. Fundamental principles of the waste management. Waste control. Collection, stocking and removing. Waste handling. Methods of waste processing and methods of waste removing. Waste management. Documentation for waste management. Evidence of waste handling. Evidence of wrapping and waste wrapping. Expert waste evaluation. Waste management plan. Control measurements and monitoring. Enterprise licences. Determination of responsibility and authorization. Restoration of internal and external communication. Employees' qualification. Development and enterprises investitions. Industrial waste. Classification. Concept of waste handling. Separate waste collection. Cleaning devices for waste gases and water. Handling with solid waste. Energetic and material waste utilization. Recycling. Radioactive waste. Analyses of ecological critical points in production processes. Data collection, analyses and presentation. Modeling. Obligatory regulations on the protection of the environment. Systematic regulation in the field of waste in RS and EU. National environment protection program. Environment protection law. Environmental protection management system ISO 14001. ISO 14000 family standards. Management systems and certification. Presentation of standard ISO 14001. Scheme of production process achieved according to the standard ISO 14001. PDAC cycle. Case of material and ecological-energetic balance in technological department achieved according to standard ISO 14001. EMAS – scheme of environmental management and audit. Energy. Definitions. Energy units. Energetics balance of the Earth. Energy use in the World. Growing of primary energy consumption – analyses. Renewable / fossil fuel energy sources. Energy and environment. Emissions and imissions. Ozonic hole. Effect of heating of atmosphere. Greenhouse effect. Emissions CO2, SO2, NOx and solid particles emissions. Measures for emissions reduction. Trade with the quotes of emissions of greenhouse gases. European pollutant emission registers. Rational use of energy in metallurgical and process industry of materials. Power plant technology. Basic concepts. Using various forms of energy. Breakdown of machinery and equipment. Work, power, efficiency. Electric power generation in Republic Slovenia. Hydroelectric power plants. Thermoelectric power plants. Cogeneration of electric and thermal energy. Advantages. Nuclear power plants. Designing environmentally-friendly products, technologies and processes. Methods and tools. Product life cycle and recycling. Analyses: environmental, economic and technical assessment. Tools and techniques. Clean technologies. Environmental labeling of products, processes and services. Case studies. Project work. Complex analyses and optimization of selected product, process or technology with inclusion of aspects and demands of environmental protection.	M.Sc. Metallurgy and Materials Engineering – Second cycle university level, year 1	45	15	15	15	6	prof.dr. Borut Kosec	Yes	
5	Physical metallurgy II	Advanced descripiton and explanaion of processes in metals and alloys with regard to deformation, solidifaction of multi component alloys, solid state phenomenon etc. Crystallographic description of martensitic and other solid state transformations. Lectures are complemented with seminar work, simulations and characterization of materials.	M.Sc.	45	10	35		6	prof. dr. Markoli	Yes	
6	Materials design	Basics of material design with focus on metallic and composite materials. Lectures are complemented with seminar work, simulations and characterization of materials and visitation to state of the art companies from the field of material dvelopment and design.	M.Sc.	45		45		6	prof. dr. Markoli	Yes	
7	Casting techniques	Casting production understanding by knowing various technologies such as permanent casting and sand casting technologies. Understanding of inner surface design and production. Emphasis on High pressure die casting technology with the knowledge of gating system design and casting technology preparation and emphasis on incestment casting technology with patern production by wax model production and 3D printed patern production.	M.Sc. Metallurgy and Materials Engineering – Second cycle university level, year 2	30	5	20	0	4	prof. dr. Primož Mrvar	Yes	in case of small number of students

Department: Materials and Metallurgy- SUMMER SEMESTER

No.	Course	Descrition of course	Level of studies	Hours				ECTS	Lecturer	Completely in English	Consultations in English
				Lectures	Seminars	Practice	Project work				
1	Nonferrous metals	The primary objectives are to teach students the basics of process engineering and technology of obtaining nonferrous metals. Lectures are complemented by exercises, for a better understanding and performance of metallurgical processes.	B.A.Sc.	45		30		5	prof. dr. Jožef Medved	depends on number of students	in case of small number of students
5	LLURGY OF IRON AND ALLOYS / STE	The purpose of this course is to provide students with the basic knowledge necessary to master steel production technology and to help them understand the importance of steel in modern society. By looking at and understanding the basic physicochemical, thermodynamic, and thermal processes in metallurgical aggregates, students will gain the basic knowledge necessary to solve specific problems. In this course, the knowledge acquired in the basic science courses is deepened and linked. The content of the subject is designed to introduce students to important process techniques and technological routes necessary for the production of high quality steel, which is important for the development of the economy and society. A high quality product can only be achieved if we master the individual sub-processes along the technological path, so that each process step is handled from the point of view of quality and environmental protection.	B.Sc.	45	15	0	30	5	assist. prof. Matjaž Knap	depends on number of students - shorter course	in case of small number of students
6	METALLURGICAL CERAMICS	The objective of the course is to teach the candidate in which industries coarse metallurgical ceramics are used and in which fine metallurgical ceramics are used. The student will learn what processes are used in the production of metallurgical ceramics. The candidate will be able to select the appropriate raw material so that the product meets the required properties. Special attention is paid to the insulating effect in the production processes, which is related to the reduction of energy consumption per unit of the product produced in a particular metallurgical reactor.	B.Sc.	45	15	0	30	5	assist. prof. Matjaž Knap	depends on number of students - shorter course	in case of small number of students
7	STEELMAKING 2	The theoretical knowledge from the B.Sc. courses and from the individual studies is linked to the technological process of steel production. The modern technologies in steelmaking and their advantages are shown. The extractive technological processes of steelmaking are highlighted from the thermodynamic point of view. Students are able to understand the processes in the steel industry and are enabled to think innovatively, which serves as a basis for further studies. Students will be able to evaluate the processes from the viewpoints of energy efficiency and environmental protection.	M.Sc.	45	15	0	30	5	assist. prof. Matjaž Knap	depends on number of students - shorter course	in case of small number of students