Course Description	
Course title:	**Strength of materials**
Neptun code:	GEMET268M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	2l. 1p.
Number of credits; hours per week	6; 3
Name and position of lecturer:	Dr. Dávid GÖNCZI senior lecturer
Contact of lecturer:	david.gonczi@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	a, 1
Requirements (exam/practical mark/signature/report, essay)	exam
Course objectives (50-100 words):	The main objective of this course is to provide the students with an introduction to the theory of elasticity, finite element modelling and plasticity. Further aim is to present the fundamental concepts and methodologies, then to apply them to the solutions of engineering problems (such as design of pressure vessels, pipes and tubes, disks or beams). Main topics: tensor algebra in indicial notation, kinematics of deformation for large and infinitesimal deformations, strain and stress tensors and measurement methods, constitutive equations, basic boundary value problem of thermoelasticity and its solution approaches, variational approach, basics of finite element modelling and plasticity.
Required readings:	1. Sadd M. H.: Elasticity: Theory, Applications and Numerics. Third edition, Academic Press, 2014. 2. Reddy J. N.: Energy Principles and Variational Methods in Applied Mechanics, 2nd Edition, John Wiley and Sons, 2002.
Recommended readings:	
Assessment methods and criteria:	

Course Description

Course title:	**Differential equations**
Neptun code:	GEMAN015M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	2p.
Number of credits; hours per week	4; 2
Name and position of lecturer:	Dr. Péter VARGA associate professor
Contact of lecturer:	peter.varga@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	s, 2
Requirements (exam/practical mark/signature/report, essay)	practical mark

Course objectives (50-100 words):	The theory of differential equations is a basic tool of diverse fields of science. Students of this course should be able to understand their behaviors and to derive solutions of differential equations. The analysis of differential equations includes numerical, geometrical and analytical methods. The course covers linear and nonlinear, and also ordinary and partial differential equations. Nonlinear equations are studied by their linearization around the equilibrium solution. A short introduction to complex functions is presented. Laplace and Fourier methods are applied both to ordinary and partial equations Object and purpose of the course: Application of differential equations for characterization of static and dynamic systems. Linear systems theory, partial differential equations theory. Numerical methods. Thematic description of the subject: Concept and classification of ordinary and partial differential equations, geometric interpretation of first order differential equations. Numerical methods (Euler, Heun), Taylor's solution of the solution, error estimation. Qualitative behavior of first-order DE, concept of linearization. The problem of the existence and clarity of the solution. Homogeneous systems of linear differential equations. Eigenvalues and eigenvectors. Exponential function of matrices. Jordan resolution. Stability test. Complex exponential function. Derivation of complex functions, Taylor series. Nonlinear DE systems. Linearization, stability. Inhomogeneous constant coefficients DE (system). Pulse and frequency response. Laplace transformation and its applications. Line integrals of complex functions. Cauchy formulas. Types of partial DEs. Fourier series, integrals. Thermal equation and wave equation. Laplace operator and equation.
Required readings:	1. Paul Dawkins: Differential Equations (free textbook, http://tutorial.math.lamar.edu/Classes/DE/DE.aspx) 2. MIT OCW: Honors Differential Equation 18.034 http://mit.ocw.edu/courses/mathematics
Recommended readings:	P. Olver : Introduction to Partial Differential Equations, Springer, 2014.
Assessment methods and criteria:	

Course Description	
Course title:	**Applied Chemistry and Transport Processes**
Neptun code:	MAKKEM272M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	2l, 1p
Number of credits; hours per week	4; 3
Name and position of lecturer:	Dr. Ferenc MOGYORÓDY associate professor
Contact of lecturer:	ferenc.mogyorody@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	s, 2
Requirements (exam/practical mark/signature/report, essay)	exam
Course objectives (50-100 words):	The purpose of the course: To introduce the students to the chemical knowledge required for non-chemical engineering activites. The course' content: Type and influence of the chemical reactions, the chemical speciality of the materials used in engineering. Quantity of the technological waters, chemical principles of technological water treatment. Water, water treatment, drinking water, industrial water, waste water and treatment. Type of catalysts and structures. Connection to chemical technologies. Raw materials of the chemical industry. Basics of Unit Operations. The chemistry of the natural gas, oil, mineral coal used for energy production. Energy production. Basics of the Green chemistry. Basics of C1-chemistry, Transport processes, viscosity, diffusion, heat transport, electric conductance, basics of hydrodynamics. Corrosion phenomena.

Required readings:	1. The material of the lectures is available for the students in pdf format. 2. P.W.Atkins: Physical Cemistry II. 3. Plawsky, Joel L. (April 2001). Transport phenomena fundamentals (Chemical Industries Series). CRC Press. pp. 1, 2, 3. ISBN 978-0-8247-0500-8. 4. Transport Phenomena (1 ed.). Nirali Prakashan. 2006. p. 15-3. ISBN 81-85790-86-8., Chapter 15, p. 15-3
Recommended readings:	
Assessment methods and criteria:	

Course Description	
Course title:	**Materials equilibria**
Neptun code:	MAKFKT345M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	2l.
Number of credits; hours per week	4; 2
Name and position of lecturer:	Prof. Dr. György KAPTAY professor
Contact of lecturer:	kaptay@hotmail.com
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	s, 2
Requirements (exam/practical mark/signature/report, essay)	exam

Course objectives (50-100 words):	Aim of the course: To demonstrate that in addition to classical temperature, pressure, and composition state determinants, phase size is determinative in the nanometer range, that is, it determines phase equilibria, not to mention chemical and electrochemical equilibria. Students will learn the expected phase balance, chemical balance in nano-sized materials and the basics of electrochemical equilibrium. To teach both theoretically and technically how to calculate phase equilibria in one- and two-component materials systems and how to read the characteristics of equilibrium from them. Keywords: System, phase, component, mole fraction, phase fraction, materials balance, characteristics of the equilibrium state, state parameters, Gibbs energy, laws of thermodynamics, condition of global and heterogeneous equilibria, phase rule, one-component phase diagrams (construction and interpretation), Gibbs energy of two-component mixtures and solutions, ideal solution and their phase diagrams (their derivation and interpretation), solutions models and the 4th law, compound phases, two-component phase diagrams (their derivation, interpretation and classification), phase diagrams + phase ratio diagrams + phase composition diagrams.
Required readings:	1. N.Saunders, AP Miodownik: CALPHAD, a Comprehensive Guide, Pergamon, 1998, 479 p 2. Lukas HL, Fries SG, Sundman B: Computational Thermodynamics. The Calphad method. Cambridge University Press, 2007, Cambridge, UK, 313 pp. 3. G.Kaptay: On the tendency of solutions to tend toward ideal solutions at high temperatures – Metall Mater Trans A, 2012, vol.43, pp. 531-543. 4. G.Kaptay: Nano-Calphad: extension of the Calphad method to systems with nano-phases and complexions - J Mater Sci, 2012, vol.47, pp.8320-833 5. G.Kaptay. The exponential excess Gibbs energy model revisited. Calphad, 2017, vol.56, pp.169-184. doi: 10.1016/j.calphad.2017.01.002. + course material (manuscript) written by G.Kaptay 2016 – 2018.
Recommended readings:	

Assessment methods and criteria:	Requirements during the semester: Personal home works for maximum 100 points (calculation of phase diagrams using EXCEL). Extra points can be gained during classes. On exam: oral presentation on two questions for maximum 100 points. Total maximum 200+ points. Teaching method: oral, using a blackboard (no computer during classes). Evaluation: At the end of semester: below 10 points: not allowed to exam; above 50 points: allowed to exam. Final mark: 100 – 119 points: satisfactory; 120 – 139 points: medium; 140 – 159 points: good; 160 and above: excellent.

Course Description	
Course title:	**Interfacial phenomena**
Neptun code:	MAKFKT347M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	2l.
Number of credits; hours per week	4; 2
Name and position of lecturer:	Prof. Dr. György KAPTAY professor
Contact of lecturer:	kaptay@hotmail.com
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	a, 1
Requirements (exam/practical mark/signature/report, essay)	exam

Course objectives (50-100 words):	Study goals: Demonstrate that material engineering practice can only be extended to nano-material production if the engineer acquires knowledge of interfacial phenomena. To make it clear that the majority of materials technologies are dependent on interfacial phenomena. Teaching the method to convert this understanding into the ability for materials and technological design Course' content: Basics on interfaces (specific surface area, molar surface area, classification and understanding of interfacial energies, the integral Gibbs energy as function of interfacial energies). Modeling interfacial energies (surface tension, surface energy, liquid/liquid interfacial energy, solid/liquid interfacial energy, solid/solid interfacial energy) as function of materials quality (chemical bond type) and temperature. Modeling interfacial energies as function of composition (Gibbs and Langmuir vs. Butler). Understanding and modeling interfacial phase separation. Phase equilibria influenced by interfacial energies (the extended phase rule and the corrected phase diagrams). Understanding interfacial forces. Modeling complex phenomena involving interfacial forces.
Required readings:	1. A.W.Adamson: Physical Chemistry of Surfaces, 5th ed., John Wiley and Sons Inc., NY, 1990. 2. J.N.Israelachvili: Intermolacular and surface forces, Academic Press, London, 1992 3. R.Defay, I.Prigogine, A.Bellemans, D.H.Everett. Surface tension and adsorption. Logmans, Green and Co, London (1966). 4. H.N. Butt, K. Graf, M. Kappl. Physics and Chemistry of Interfaces. Weinheim: Wiley (2003). 5. N.Eustathopoulos, M.G.Nicholas, B.Drevet: Wettability at High Temperatures, Pergamon, 1999, 420 pp. + course material (manuscript) written by G.Kaptay 2015 – 2018.
Recommended readings:	

Assessment methods and criteria:	Requirements during the semester: One home work + one test for maximum 100 points. Extra points can be gained during classes. On exam: oral presentation on two questions for maximum 100 points. Total maximum 200+ points. Teaching method: oral, using a blackboard (no computer during classes). Evaluation: At the end of semester: below 10 points: not allowed to exam; above 50 points: allowed to exam. Final mark: 100 – 119 points: satisfactory; 120 – 139 points: medium; 140 – 159 points: good; 160 and above: excellent.

Course Description	
Course title:	**Intellectual properties law**
Neptun code:	MAKPOL264M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	3p.
Number of credits; hours per week	4; 3
Name and position of lecturer:	Prof. Dr. György CZÉL professor
Contact of lecturer:	gyorgy.czel@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	s, 4
Requirements (exam/practical mark/signature/report, essay)	practical mark

Course objectives (50-100 words):	Study goals: The purpose of subject is to acquaint the students with the forms of intellectual property law. Course content: The means of effective protection of intellectual property is demonstrated in the framework of this subject. The following topics are especially highlighted: 1. The branches of protection of intellectual property and their fields 2. The concept, subject and extent of copyright 3. The concept and significance of voluntary register of works and the process of procedure Copyrights and their limits 4. The professional book as a task of copyright; the cases of free adaptation 5. The professional paper as a paper of copyright, citation and reference 6. Linked and adjacent legitimacy and their limits in the copyright 7. Specification of safe-keeping forms known in the industrial legal protection and the short review of their different fields. 8. The content and limits of licences and patents as the safe-keeping form of industrial legal protection 9. The structure of description of patent. The conditions of patentability 10. Possibilities of obtaining the EU patents 11. The development and significance of patent data base 12. Content and development of the utility model protection 13. Significance and sphere of protection of trade marks. Content of classification system developed in Viena and Nice. The Community Trade Mark 14. Extent and significance of design protection 15. Significance of geographical indication. Method of validation and content of this form of protection
Required readings:	1. WIPO: Protection of Intellectual properties 2. L. Bently, B. Sherman: Intellectual Property Law 3. R. Radhakrishnan,S. Balasubramanian: Intellectual Property Rights 4. Howell Claire, Farrand Benjamin: Intellectual Property Law
Recommended readings:	
Assessment methods and criteria:	

Course Description	
Course title:	**Project management**
Neptun code:	MAKMET30M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	4p
Number of credits; hours per week	4; 4
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, 1-4	s, 4
Requirements (exam/practical mark/signature/report, essay)	exam
Course objectives (50-100 words):	The course aims at helping students to be familiar with project management concepts, terms, roles and processes. They will learn: How projects are defined. How the structure of an organization impacts project management. How project management roles and responsibilities are defined. How all projects can be mapped to the same basic life cycle structure. How project management can be organized into functional areas. Course content: Project management has evolved to plan, coordinate and control the complex and diverse activities of modern industrial, commercial and management change and IT projects. The purpose of project management is to foresee or predict as many of the dangers and problems as possible and to plan, organize and control activities so that projects are completed successfully in spite of all the risks. The course involves the descriptions about perspectives, principles, stakeholders, sponsors, managers and processes of a general project. Moreover the course provides detailed information about managing the team, scope, schedule, budget, quality and risks of the projects.

Required readings:	1. Dennis Lock: Project Management. Gower Publishing Limited (UK), 2013. ISBN-13: 978-0-566-08772-1 2. Rodney Turner: Handbook of Project Management. Gower Publishing Limited (UK), 2012 3. Scott Berkun: Art of Project Management. Cambridge, MA: O'Reilly Media. ISBN 0-596-00786-8 (2005) 4. A Guide To The Project Management Body Of Knowledge, 3rd ed., Project Management Institute. ISBN 1-930699-45-X (2003) 5. James Lewis: Fundamentals of Project Management, 2nd ed., American Management Association. ISBN 0-8144-7132-3 (2002)
Recommended readings:	Berkun, Scott. Art of Project Management. Cambridge, MA: O'Reilly Media. ISBN 0-596-00786-8 (2005) Brooks, Fred. The Mythical Man-Month, 20th Anniversary Edition, Adison Wesley. ISBN 0-201-83595-9 (1995) Heerkens, Gary. Project Management (The Briefcase Book Series). McGraw-Hill. ISBN 0-07-137952-5 (2001) Kerzner, Harold. Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 8th Ed., Wiley. ISBN 0-471-22577-0 (2003) Lewis, James. Fundamentals of Project Management, 2nd ed., American Management Association. ISBN 0-8144-7132-3 (2002) Meredith, Jack R. and Mantel, Samuel J.. Project Management : A Managerial Approach, 5th ed., Wiley. ISBN 0-471-07323-7 (2002) Project Management Institute. A Guide To The Project Management Body Of Knowledge, 3rd ed., Project Management Institute. ISBN 1-930699-45-X (2003)
Assessment methods and criteria:	Signature: test writing (20 questions, at least 11 good answers = allowed to exam) Exam: written work based on 3 essay tasks

Course Description	
Course title:	**Quality management systems**
Neptun code:	MAKMKT520EN
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	3l.

Number of credits; hours per week	4; 3
Name and position of lecturer:	Prof. Dr. Csaba DEÁK, professor
Contact of lecturer:	csaba.deak@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	s, 4
Requirements (exam/practical mark/signature/report, essay)	exam
Course objectives (50-100 words):	The objective of the course is to learn quality management concept of production companies; the main quality-related tasks at management level. The students will be able to organise their works and work processes in a quality-oriented manner. The topics are supported by best practice case studies. The students solve practice-oriented project tasks. Course content: Essentials and tendencies of quality approaches. The main areas of quality management (QM). Special QM tasks in material science research institutes and laboratories. Process model of quality management. Introduction to the ISO 9001 quality management standard; QM audit process. Essentials of Total Quality Management (TQM). Statistical Process Control (SPC); its place in QM and the connecting managerial tasks. Lean Six Sigma as a QM/QA system. Managerial support of continuous improvement (CI). Supplier Quality Management (SQM), tendencies and standards. Challenges of Quality 4.0.
Required readings:	• Juran, J. M.: A history of managing for quality: The evolution, trends, and future directions of managing for quality, ASQC QP, 1995. • Juqulum, R.: Design for lean six sigma: A holistic approach to design and innovation, Wiley, 2008. • Chandupatla, T.R.: Quality and reliability in engineering, Cambridge, 2009. • Luis, R-L: Building quality management systems: Selecting the right methods and tools, CRC, 2013.
Recommended readings:	
Assessment methods and criteria:	

Course Description	
Course title:	**Metal technologies**
Neptun code:	MAKMET311M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	3l. 2p.
Number of credits; hours per week	10; 5
Name and position of lecturer:	Prof. Dr. Tamár KÉKESI professor
Contact of lecturer:	tamas.kekesi@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	a, 1
Requirements (exam/practical mark/signature/report, essay)	
Course objectives (50-100 words):	Initially, the course aims at delivering the general knowledge of the properties, the significance of metals. Further, the staple processes used for the extraction, refining, casting and shaping of metals are discussed on an introductory level. The theoretical fundamentals are outlined and the typical technologies are introduced. The scope is more general and compehensive than detailed and specific. According to the complexity of the subject, the content is divided into three separate segments: 1) The significance of primary and secondary raw materials for producing and processing metals, the importance of physic-chemical equilibrium conditions in the standard pyro- and hydrometallurgical processes. Examples are provided for the implementation of roasting, smelting, leaching, solution purification and electrolytical technologies, the treatment of metal melts and metal containing solutions. 2) The main processes of casting and solidification. Moulding materials and mould design. Gravity, centrifugal and pressure casting technologies. Testing methods and properties of castings. 3) The main mechanical characteristics and the simulation of plastic deformation. Materials and equipment of metal forming. The technology of hot and cold rolling, forging, extruding and wire drawing. The principles and practice of heat treatment.

Required readings:	1. T. Kékesi: Fundamentals of chemical metallurgy. Univ. Miskolc, electronic textbook, http://metont.uni-miskolc.hu/wp-content/uploads/ 2. F. Habashi: Textbook of pyrometallurgy, Met. Extr. Quebec, Canada, ISBN 2-922-686-05-1 3. F. Habashi: Textbook of hydrometallurgy, Met. Extr. Quebec, Canada, ISBN 2-980-3247-0-1 4. J. Campbell: Castings, Elsevier, 2003, ISBN: 978-0-7506-4790-8, https://doi.org/10.1016/B978-075064790-8/50018-8 5. Technology of metal forming processes, Surender Kumar, Published by Asoke K. Gosh, Prentice-Hall of India Private Limited, M-97, Connaught Circus, New Delhi-110001, ISBN: 978-81-203-3425-0 6. Handbook of metalforming processes, Henry E. Theis, New York, 1999., ISBN: 0-8247-9317-X
Recommended readings:	
Assessment methods and criteria:	

Course Description	
Course title:	Solidification
Neptun code:	MAKFKT357M
Status: core, specialization, optional, other:	core
Type : lecture/seminar (practical)	2l. 1p.
Number of credits; hours per week	6; 3
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, 1-4	a, 3
Requirements (exam/practical mark/signature/report, essay)	exam

Course objectives (50-100 words):	Study goals: presentation of the basics, methods and equipments of the solidification of metals. Course content: Students will learn the fundamentals of the solidification of pure metals and solid solutions. They will learn about the nucleation (homogenous and heterogenous) and growth of grains by pure metals, solid solutions, eutectic alloys and peritectic alloys. They will understand how the basic binary phase diagrams are constructed and how they describe the methods of solidification. Micro and macro segregation also will be presented.
Required readings:	1. Kurz W.: Fundamentals of Solidification 2. Stefanescu D.M. : Science and Engineering of Casting Solidification 3. Glicksman M. E. : Principles of Solidification 4. Fredriksson H., Akerlind U.: Materials Processing during Casting 5. Flemings M.C.: Solidification processing
Recommended readings:	
Assessment methods and criteria:	

Course Description	
Course title:	**Physical metallurgy of heat treated metals and alloys**
Neptun code:	MAKFKT348M
Status: core, specialization, optional, other:	HEAT TREATMENT AND METAL FORMING specialization
Type : lecture/seminar (practical)	3l.
Number of credits; hours per week	6; 3
Name and position of lecturer:	Prof. Dr. Péter BARKÓCZY professor
Contact of lecturer:	peter.barkoczy@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	a, 1
Requirements (exam/practical mark/signature/report, essay)	exam

Course objectives (50-100 words):	The attached areas during the course: basics of solid state phase transformation. Princilples of recrystallization and recovery, the annealing heat treatment. Kinetics of precipitiation from super saturated solid solution, the anging process. Basics of allotropic phase transformation of pure metals and solid soutions. Ausztenitization and normalizing of steels, and the basics of transformation diagrams. Principles of martensitic and bainitic transformations, quenching, aging and tempering. The course mainly deals with the phisical metallirgic description of the processes, but give some additional practical data and process related to aluminum, copper and steel heat treatments.
Required readings:	1. S. Banerjee and P. Mukhopadahyay: Phase transformations, Pergamon Press, 2. D. A. Porter and K. E. Easterling: Phase transformations in metals and alloys, CRC Press 3. J. Humphreys: Recrystallization and related phenomena, Elsevier
Recommended readings:	
Assessment methods and criteria:	

Course Description	
Course title:	**Fundamentals of metal forming**
Neptun code:	MAKFKT350-17-M
Status: core, specialization, optional, other:	HEAT TREATMENT AND METAL FORMING specialization
Type : lecture/seminar (practical)	3l.
Number of credits; hours per week	6; 3
Name and position of lecturer:	Dr. Sándor Kovács senior lecturer
Contact of lecturer:	sandor.kovacs@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	a, 3
Requirements (exam/practical mark/signature/report, essay)	exam

Course objectives (50-100 words):	Mechanism of plastic deformation. Anisotropic behaviour of deformed body. Cold and hot deformation, recrystallization. Continuum mechanical aspects of plastic deformation. A summary of tensor calculus. Deformation and stress state in deformable body. Constitutive law of materials, and methodology on determination of their parameters. Workability of metals and mathematical description of damage evaluation. Tribology of metal forming processes and determination of its parameters. Computation methods for the calculation of force and deformation on basic forming processes. Using of engineering technical computing software for the planning of metal forming processes.
Required readings:	1. B, Avitzur, Metal Forming : Proceses and Analysis, Mc Graw-Hill Book Company, 1968. ISBN-10:007002510X ISBN-13:978-0070025103 2. R.H.Wagoner, J.-L. Chenot : Metal Forming Analysis. Cambridge, University Press, 2001, ISBN-10 0-521-64267-1 ISBN-13 978-0-521-64267-5 3. R.H.Wagoner, J.-L. Chenot : Fundamentals of metal forming. John Wiley & Sons, Inc. 1997, ISBN 10:0471570044 ISBN-13:9780471570042 4. Han-Chin Wu : Continuum Mechanics and Plasticity. Chapman & Hall/CRC Press,2005, ISBN-10 :1584883634, ISBN-13 9781584883630
Recommended readings:	
Assessment methods and criteria:	

Course Description	
Course title:	**Simulation of heat treatment processes**
Neptun code:	MAKFKT349M
Status: core, specialization, optional, other:	HEAT TREATMENT AND METAL FORMING specialization
Type : lecture/seminar (practical)	1l. 3p.
Number of credits; hours per week	8; 4
Name and position of lecturer:	Prof. Dr. Péter BARKÓCZY professor
Contact of lecturer:	peter.barkoczy@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	s, 2
Requirements (exam/practical mark/signature/report, essay)	practical mark

Course objectives (50-100 words):	Basics of the simulation and modelling. Concept of physical and numerical simulations. Difference between the property and microstructural simulation. Solution of the kinetic equation. Numerical computation methods. Simulation of phase transformation based on a regression model. Cellular automaton method, and its application in materials science. Level-Set method and the solution possibillities of the level set equation.
Required readings:	1. B. Chopard and M. Droz: Cellular automata simulation of Physical Systems, Cambridge University Press 2. J. L. Schiff: Cellular Automata, Wiley-Interscience 3. Czichos, Saito, Smith ed.: Handbook of Metrology and Testing, Springer
Recommended readings:	
Assessment methods and criteria:	

Course Description	
Course title:	**Simulation of deformation technologies**
Neptun code:	MAKFKT351M
Status: core, specialization, optional, other:	HEAT TREATMENT AND METAL FORMING specialization
Type : lecture/seminar (practical)	1l. 3p.
Number of credits; hours per week	8; 4
Name and position of lecturer:	Dr. Sándor Kovács senior lecturer
Contact of lecturer:	sandor.kovacs@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	s, 4
Requirements (exam/practical mark/signature/report, essay)	practical mark

Course objectives (50-100 words):	The course's subject are specified in the followings: - presenting how to opearate a die-forging based FEM-software which is used for designing metal forming technologies; - comparing the results of the measuerements to the results of the simulations; - rolling, forging, drawing and extrusion forming problems' termo-mechanical approach; - solving specifed metal forming boundary condition problems with FEM softwares; - implementing an expirement of a metal forming problem then simulating it with a FEM software; - comparing the measured and the computed results of the problem.
Required readings:	1. H.S. Valberg: Applied metal forming including FEM analysis. Cambridge University Press. 2010. 2. MSc Marc Tutorials 3. Páczelt István, Szabó Tamás, Baksa Attila: A végeselem-módszer alapjai. Prof. Dr. Páczelt István, 2007
Recommended readings:	4. R.H. Wagoner, J.L.Chenot: Metal Forming Analysis. Cambridge University Press. 2001. 5. P.M. Dixit, U.S.Dixit : Modeling of Metal forming and Machining Processes, Springer, 2008 6. Pánczelt István- Herpai Béla: A végeselem-módszer alkalmazása rúdszerkezetekre. Műszaki Könyvkiadó, Budapest 1987 7. Bojtár Imre – Gáspár Zsolt: A végeselemmódszer matematikai alapjai. BME Tartószerkezetek Mechanikája Tanszék, Budapest, 2009
Assessment methods and criteria:	

Course Description	
Course title:	**Complex planning or Project work**
Neptun code:	MAKFKT352-17-M
Status: core, specialization, optional, other:	HEAT TREATMENT AND METAL FORMING specialization
Type : lecture/seminar (practical)	2p.
Number of credits; hours per week	4; 2

Name and position of lecturer:	Prof. Dr. Zoltán Gácsi professor emeritus
Contact of lecturer:	zoltan.gacsi@uni-miskolc.hu
Prerequisite course(s):	
Language of the course:	English
Suggested semester: autumn /spring, 1-4	s, 4
Requirements (exam/practical mark/signature/report, essay)	practical mark
Course objectives (50-100 words):	Aim of the course to prepare students to manage and write a successfully thesis. Course content: design, implement and completion of a project with a guidance of a lecturer. The project consist of literature research, processing (and carrying out experiments). At the end of the semester, students present their results/ projects.
Required readings:	1. ASM Handbook, Vol. 9, Metallography and Microstructures 2. ASM Handbook, Vol. 10, Materials Characterization 3. ASM Handbook, Vol. 21, Composites
Recommended readings:	
Assessment methods and criteria:	