Faculty of Mechanical Engineering

IMPORTANT NOTES

If for one subject you can find several different types (lecture, practice, laboratory) of courses then please choose one and only one course from each type in order to be able to perform the subject's requirements successfully.Civil Engineering courses are on the website seperately. Courses chosen from the offer of Faculty of Civil Engineering will be checked and arranged individually by the departmental coordinator.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENAEGK	Heat Engines	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	19-2-ENG-LAB1	English	WED:14:15-16:00;
Laboratory	19-2-ENG-LAB2	English	WED:14:15-16:00;
Lecture	19-2-ENG-E	English	WED:12:15-14:00(D316A);
Practice	19-2-ENG-G	English	WED:14:15-16:00(D316A);

Heat Engines BMEGEENAEGK Fuels, fuel technology. Different type of boiler construc- tions. Circulation in boilers. Steam and gasturbine cycles. Theoretical and real cycles. Impulse and reaction stages. Radial and axial turbines. IC engines. Otto/Diesel engines, crank mechanism, valve arrangement and constructions. Fuel systems of IC engines. Refrigerators and heat pumps. Mechanical construction, dimensioning. Control and op- eration. Environmental aspects. 4 hours/4 credits.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENAETD	Engineering Thermodynamics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	19-2-ENG-E	English	MON:08:15-10:00(D318);
Lecture	19-2-FRA-E	French	
Practice	19-2-FRA-G	French	
Practice	19-2-ENG-G	English	TUE:10:15-12:00(D218);

Engineering Thermodynamics BMEGEENAETD Basic concepts. Work, heat, entropy, specific heats. Zeroth Law of Thermodynamics. Temperature scales. Properties of pure substances. First Law of Thermodynamics, internal energy and enthalpy, closed and open systems. Simple processes with ideal gas. Gas power cycles: heat engines, refrigerators, heat pumps. Second Law of Thermodynamics, exergy, losses due to irreversibility. Liquids and vapors. Equations of state. Two-phase systems. Basic cycles of power generation. Mixtures of gases, Psychrometrics. 3 hours/3 credits.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENBGHK	Heat transfer G	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	19-2-DEU-E	German	
Practice	19-2-DEU-G	German	

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMLCA	LCA of Powe generation system	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	19-2-ENG-LAB	English	
Lecture	19-2-ENG-E	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWAT	Advanced Thermodynamics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	19-2-ENG-E	English	TUE:10:15-12:00(KF82);
Practice	19-2-ENG-G1	English	THU:08:15-09:00(D224);

Practice	19-2-ENG-G2	English	THU:09:15-10:00(D224);

The aim is to introduce the students to the hierarchy of modells (theories) of thermodynamics (classical, ordinary/ homogeneous nonequilibrium and irreversible/continuum nonequilibrium thermodynamics) with selected applications demonstrating the role of the basic concepts in engineering. During the semester the students deepen their understanding of the basic concepts and methods of the subject, like equilibrium, energy/exergy/extropy, material modelling, etchellip;. A) Homogeneous systems - Ordinary (equilibrium) thermodynamics 1) Basic thermodynamic concepts. Models, theories and laws. Extensives and intensives. Gibbs relation. Thermodynamic potentials. Thermodynamic stability. Phases and phase equilibrium. Gases, liquids and solids. Math1: partial derivatives, Math2: Legendre transformations, differentials. 2) Zeroth, First and Second Law - statics Conceptual questions: equilibrium, energy, work, perpetuum mobile, quasistatic quot;processesquot;. 3) EOS examples: Ideal gas, Van der Waals gas, virial gas Ideal elastic wire, rubber wire, ideal elasticity in 3d. 4) Laws of thermoDYNAMICS Math3: Differential equations, stability, Liapunov-functions. Gibbs relation and differential equations. Equilibrium. Quasistatic and irreversible processes. Single body in an environment. 5) System of bodies and environments. Heat and work. Reservoirs, extended systems. 6) Exergy analysis. Entropy generation minimization. Heat exchangers, power plants. 7) Multicomponent phase equilibrium, solutions. B) Continua - Non-equilibrium thermodynamics 8) Basics - balances of basic quantities Balances, partial diff. equations, constitutive functions, objectivity. Math4: Tensor analysis, indices. 9) Second law. Entropy production. Linear laws. Onsager reciprocity. Isotropy. Local equilibrium. 10) Heat conduction, diffusion and flow in one component fluids. Cross effects. 11) Heat conduction and flow in isotropic solids. Cross effects. 12) Out of local equilibrium. Internal variables. Heat conduction and flow in isotropic solids. Cross effects. Rheology. Poynting-Thomson body. 13) Measurement of parameters, applications, etc., constructal theory, etc.. Fuel cells.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWDA	Final project A	Mid-semester mark	15

Course type	Course code	Course language	Timetable information
Practice	19-2-ENG-G	English	

In course of the Final Project A one student or group of 2 students will work on one selected challenging problem of mechanical engineering. Several experimental and/or numerical project proposals will be announced by the project leaders. The aim of the course is to develop and enhance the capability for complex problem solving of the students under advisory management of their project leader. At the end of each semester a written Project Report is to be submitted and the summary and findings of the investigations on the selected problem is to be presented as Project Presentation.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWDB	Final project B	Mid-semester mark	15

Course type	Course code	Course language	Timetable information
Practice	19-2-ENG-G	English	

The aim of the subject of is to demonstrate the ability of the student to solve high level, practical engineering problems, based on acquired knowledge in the fields of mechanical engineering. The projects have to be prepared by the students under the guidance of supervisors. The Final Projects include tasks in design, simulations, laboratory tests, manufacturing as well as controlling, interfacing and software tasks. The expected result is mostly a Final Report prepared according to written formal requirements. During the Final Exam, the results have to be explained in an oral presentation.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWEP	Energy conversation units and their equipment	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	19-2-ENG-E	English	TUE:16:15-18:00(D218);
Practice	19-2-ENG-G	English	TUE:18:15-19:00(D218);

Basics. Cooling systems and main parameters. Absorption cooling systems and special cooling systems. Fuel cells. Combustion technology, parameters and emissions. Different hot water and steam generation systems. Different hot water and steam generation main parameters. Steam turbines, different steam turbine cycles. Steam turbines, different steam turbine constructions. Gas turbines, different gas turbine constructions and cycles. Main parameters and characteristic of internal combustion engines. Management of internal combustion engines. Gas engines. Cogeneration and tri-generation systems and parameters.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWM2	Measurements in Thermal Engineering	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	19-2-ENG-LAB	English	FRI:12:15-16:00(D318);
Lecture	19-2-ENG-E	English	FRI:12:15-14:00(D318);

Fundamentals of measurement theory. Emission components and analysers. Emission analysers. Temperature measurement. Power plant and measuring equipment, measurement, accreditation, quality assurance.

Measurement procedures and data processing techniques. Dynamical process identification. Cooling system test. High speed pressure measurement. Discontinuous boiler test and calculations. Gas Engine test. Gas Turbine test.			
Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWPR	Teamwork project	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	19-2-ENG-LAB	English	

The complex task covers a semester project in the diverse topics of energetics.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWSE	Simulation of Energy Engineering Systems	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	19-2-ENG-LAB	English	MON:15:15-17:00(D216);
Lecture	19-2-ENG-E	English	MON:14:15-15:00(D216);

Simple example, modeling approaches. Phases of setting up lumped theoretical mathematical models. Conservation laws of lumped theoretical mathematical models. Some constitutive equations. Using Matlab interactively. Example: Combustion kinetics. Using Simulink interactively. Simulation options in Simulink. Linearizing a model. Programming Matlab. Example: Handling big measured data set.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWTP	Thermal Physics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	19-2-ENG-LAB	English	THU:18:15-19:00(D216);
Lecture	19-2-ENG-E	English	THU:16:15-18:00(D216);

Physical backgrounds, mechanism and models of heat conduction in solids; measurement of thermophysical properties; steady state and transient methods; numerical modeling of 1D and 2D heat conduction problems, inverse heat conduction problem. Heat conduction review (heat diffusion equation, boundary conditions). What are thermophysical properties? Different heat conduction models. Finite difference and control volume method for the solution of heat conduction problems. Measurement of the thermal conductivity. Measurement of the thermal diffusivity. Measurement of the specific heat capacity; direct determination of the temperature dependency of the properties. Inverse heat conduction problems. 2D steady-state heat conduction with contact boundary condition. Transient heat conduction with different boundary conditions (modeling the laser flash method). Transient heat conduction with contact boundary condition. Transient heat conduction with temperature dependent thermophysical properties (modeling the BICOND method).

Subject code	Subject name	Requirement	ECTS credit
BMEGEGEA3CD	Fundamentals of CAD	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	AL2	English	WED:14:15-16:00(D303);
Lecture	A_EA	English	MON:08:15-10:00(R113,R114);

Aims and objectives:The goal of the course is to present the basic methods of computer aided design and introduction to design applications. Topics:Definitons of CAD, CAM and CAE. Sequential engieneering.Concurrent Engineering. Integration of CAD, CAM and CAEthrough database. The concurrent engineering process. Theproduct model formed from aspect models. Product datamanagement (PDM) systems. Component of CAD/CAM/CAE systems. Hardware configurations for CAD/CAM/CAEsystems. Computer graphics. Typical graphics operations.Geometric modelling. Feature based modelling. Parametricmodelling. CAD/CAM databases. 3 hours/4 credits.

Subject code	Subject name	Requirement	ECTS credit
BMEGEGTAG92	Machine tools and manufacturing systems	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	01	English	FRI:12:15-14:00(G115);

Subject code	Subject name	Requirement	ECTS credit
BMEGEGTMW01	Advanced Manufacturing	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	A2	English	FRI:09:15-12:00(G113);
Lecture	A1	English	FRI:08:15-09:00(G113);

Introduction to Advanced Manufacturing. Visiting the manufacturing laboratory of the Department. Conventional machining operations. Fundamentals of machining operations. Mechanics of metal cutting. Machinability. Chip control. Fundamentals of advanced manufacturing (non-conventional machining). Reverse engineering. Rapid Prototyping. Mold design and manufacturing. Production Planning - Material Requirements Planning. Production Planning - Advanced models and algorithms. Consultation on semester essay. Electro Discharge Machining EDM), processes and application. Micro EDM machining. Laser Beam Machining. Laser marking. Rapid Prototyping. NC tool path planning by CAM system. Hard Cutting. Gear production.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMAGM2	Strength of Materials	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	AE	English	TUE:14:15-16:00(KF83);
Practice	AG1	English	THU:12:15-14:00(KF83);

Strength of Materials BMEGEMMAGM2 Stress state and strain state in linear elastic bodies. Simple tension and compression. Simple Hookersquo;s law. Area mo- ments of inertia. Bending. Torsion. Combine loads: tension and bending, shear and bending. Bending of curved plane beams. Principal stresses and strains. Mohrrsquo;s circles. Eigen- values and eigenvectors of the stress tensor. Dimensioning for combined loads. Mohr- and von Mises-type equivalent stresses. Calculation of deflection and slope of beams. Work theorems of elasticity (Betti, Castigliano). Eulerrsquo;s theory of slender beams. Statically indeterminate structures and frames. Thin pressure vessels, - theory of membranes. 4 hours/5 credits.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMBXM2	Strength of materials	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	NE	German	
Practice	NG2	German	
Practice	NG1	German	

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMBXM4	Vibrations	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	NE	German	
Practice	NG1	German	

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMG11	Machine Tool Vibrations	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	E	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMM02	Dynamics of Machines	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	L	English	
Lecture	E	English	MON:10:15-12:00(MM_I29);

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMW01	Analytical Mechanics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	E	English	MON:17:15-20:00(KF81);

Review of Dynamics, Strength of Materials and Vibrations. Drsquo;Alambertrsquo;s Priciple. Dynamic effects in Strength of Materials. Maximum equivalent stress calculation in structures of large acceleration (ventilator and turbine blades, engine parts). Natural frequencies and vibration modes of multi DoF systems. Rayleighrsquo;s ratio, Stodola iteration and Dunckerleyrsquo;s formula. Calculation of natural frequencies in beam structures by means of analytical estimation andfinite element code. Natural frequencies and vibration modes of continuum beams (bending, longitudinal). Vibrations of strings. Calculation of natural frequencies in beam structures subjected to bending vibrations by solving partial differential equations. Bending vibrations of rotating shafts. Variation of natural frequencies due to gyroscopic effects.Campbell diagrams.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMW02	Finite Element Analysis	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	L1	English	WED:15:15-17:00(MM_F15);
Laboratory	L3	English	THU:16:15-18:00(MM_F15);
Laboratory	L2	English	THU:14:15-16:00(MM_F15);
Lecture	E	English	TUE:08:15-10:00(MGFEA);

The basic equations of linear elasticity. The principle of the total potential energy mimum. Finite element discretization. Shear effect in beams, Timoshenko beam theory. FE formulation of Timoshenko beams. Isoparametric Timoshenko beam element, shear locking, interpolation with exact nodal solution, examples. The basic equations in plane elasticity. Isoparametric quadrilateral elements, shape functions, Jacobian matrix and deteminant. Numerical integration, Gaussian rule. Stiffness matrix and load vectors of quadrilaterals. Stability of linear elastic systems, the method of Trefftz. FE formulation of stability problems, geometric stiffness matrix. Buckling, lateral buckling and lateral-torsional buckling of slender beams with symmetric cross section, examples. Torsion of straight prismatic beams. Free vibration analysis with FEM, vibration of Timoshenko beams. FE solution of damped forced vibrations, Duhamel integral. Direct time integration, central difference method, Newmarkrsquo;s method, numerical examples. Second order dynamics, buckling vibration of beams. Dynamic stability. Modeling examples inANSYS including elasticity, plasticity, elastic stability, dynamics and thermomechanics problems

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMW05	Elasticity and Plasticity	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	E	English	TUE:14:15-15:00(D316A);
Practice	G	English	TUE:15:15-16:00(D316A);

Introduction to the constitutive modeling in solid mechanics. Classification of the constitutive theories. Gradient, divergenceand curl in cylindrical coordinate system. Small strain theory. Compatibility of strain. Governing equations of linear elasticity. Hookersquo;s law. Plane stress and plane strain problems. Airy stress function.Torsion of prismatic bar. Analytical stress solution of rotating disc and of thickwalled tube with internal pressure. One-dimensional plasticity. Uniaxial extension and compression problems with hardening. Elastic-plastic deformation of thick-walled tube with internal pressure. Haigh-Westergaard stress space. Formulation of the yield criteria. Linear isotropic and kinematic hardening. Nonlinear hardenings. Formulation of the constitutive equation in 3D elastoplasticity. Radial return method.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMW06	Nonlinear Vibrations	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	E	English	TUE:08:15-09:00(D316A);
Practice	G	English	TUE:09:15-10:00(D316A);

Nonlinearities in mechanical systems: springs, dampers, inertia. Phase plane analysis of 1 degree-of-freedom systems. Saddles, nodes and spirals, stable and unstable equilibria. Vibrations of conservative nonlinear systems. Catastrophe theory: typical bifurcations of equilibria. Construction of trajectories and their analysis in case of inverted pendulum supported by spring, pitchfork bifurcation. The dynamic effects of nonlinear damping. Forced vibration and resonances in systems of nonlinear springs. Analytical and numerical calculation of resonance curves in case of hardening and softening characteristics. Self-excited vibrations. Lieacute;nard and Bendixson criteria for limit cycles. Hopf bifurcation theory. Stick-slip oscillations, estimation of stable and unstable periodic motions.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMW07	Coupled Problems in Mechanics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	L	English	WED:12:15-14:00(MM_F15);
Lecture	E	English	WED:12:15-14:00(MM_I29);

Coupled field problems. Diffusion equations. Coupled piezo-thermo-mechanical equations. Steady-state thermal analysis. Thermo-mechanical analysis. Micro-electromechanical systems. Beam and plate type microstructures. Sensors and actuators. Piezoelectric-thermo-mechanical analysis of an actuator. Electro-mechanical analysis of a capactive pressure sensor. Fluid-structure interaction. Fluid-structure coupled acoustic analysis. Contact problems. Contact simulation of two microcantilevers. Shape memory alloys, smart structures.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMWDA	Final Project A	Mid-semester mark	15

Course type	Course code	Course language	Timetable information
Practice	A	English	

The Final Project A subject is dedicated to the preparation of the first half of the MSc thesis. Each student must choose a proposal and a supervisor or supervisors. The proposals are available at the websites of the department or these can be requested from the professors in the course of a personal communication. The aim of the subject is to develop and enhance the problem solving capability of the students under advisory management of their supervisor. The requirement is a practical mark at the end of the semester, which is determined entirely by the supervisor.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMWDB	Final Project B	Mid-semester mark	15

Course type	Course code	Course language	Timetable information
Practice	B	English	

The Final Project B subject is dedicated to prepare the second half of the MSc thesis. As the continuation of the Final Project B, the aim of the subject is to demonstrate the ability of the student to solve high level, practical engineering problems, based on acquired knowledge in the fields of mechanical engineering. In some special cases the students can choose a different topic than that of the Final Project A, however in this case the thesis should be prepared in the course of one semester. The projects have to be prepared by the students under the guidance of supervisors. The Final Projects include tasks in design, simulations, laboratory tests, manufacturing as well as controlling, interfacing and software tasks. The expected result is mostly a Final Report prepared according to written formal requirements. During the Final Exam, the results have to be explained in an oral presentation.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMMWSZ	Summer Internship	Signature	0

Course type	Course code	Course language	Timetable information
Practice	INTER	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTAGE3	Novel engineering materials	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	Ea	English	TUE:12:15-14:00(MT103);

BSc in Mechanical Engineering 2N-AG0/2NAAG0 Design and Technology Specialization compulsory / elective subject SUBJECT DATA SHEET AND REQUIREMENTS last modified: 29th May 2014 NOVEL ENGINEERING MATERIALS KORSZERŰ MÉRNÖKI ANYAGOK 1 Code Semester Nr. or fall/spring Contact hours/week (lect.+semin.+lab.) Requirements p / e / s Credit Language BMEGEMTAGE3 spring 2+0+0 p 3 English 2. Subject's responsible: Name: Position: Affiliation (Department): Dr. István Mészáros associate professor Dept. of Materials Science and Engineering 3. Lecturer: Name: Position: Affiliation (Department): Dr. István Mészáros associate professor Dept. of Materials Science and Engineering 4. Thematic background of the subject: The subject gives an introduction to the up-to-date research fields of materials science. Special attention is paid to the novel materials used in engineering appications. 5. Compulsory / recommended prerequisites: Compulsory: (subject's name, code) Suggested: (subject's name, code) 6. Main aims and objectives, learning outcomes of the subject: The structure, properties of novel structural and functional materials used in mechanical and electrical engineering applications and their testing methods are discussed. The technological processes and their practical aspects are discussed. Fundamental concepts of material structures and the principles of material properties and their relations. Special attention is paid to materials used in the electronics industries including their production and technological usability. 7. Method of education: Lecture 2 h/w, seminar 0 h/w, laboratory 0 h/w 8. Detailed thematic description of the subject (by topic, min. 800 character): Topics include: Basics of crystallography, crystal defects, dimensional effects, nano-, micro-, and macrostructures, multi-component systems. Thermal behavior, diffusion mechanisms. Phase transformations, heat treatments, recrystallization. Mechanical properties and their measurements. Types and properties of novel structural and stainless steels. Fundamental new concepts in steel development. High entropy alloys. Alloys used in biomedical engineering applications. Materials deterioration processes such as corrosion, fracture, fatigue (mechanical, thermal, etc.), creep, migration. Microscopy, electron microscopy, X-ray diffraction. Conduction properties, conductive, superconductive, resistive, and insulator materials. Semiconductor materials. Effects of material properties on semiconductor materials used in microelectronics and in integrated optoelectronics. Insulator, dielectric and ferro-electric materials. Production of semiconductor single crystals and the related measurement techniques (Hall, CV). Non-metallic materials in electrotechnics. Magnetic properties and the types of magnetic materials used in industrial applications. Intelligent materials. Shape memory and superelastic alloys. 9. Requirements and grading a) in term-period: participation on lectures, mid-semester test in the 7th week of the semester b) in examination period: written and oral exam c) Disciplinary Measures Against the Application of Unauthorized Means at Mid-Terms, Term-End Exams and Homework Supplement to 1/2013. (I. 30.) Dean's Order (Codicil): The following students are subject to disciplinary measures. (a). Those students who apply unauthorized means (book, lecture notes, etc.), different from those listed in the course requirements and/or adopted by the lecturer in charge of the course assessment, in the written mid-term exams taken, and/or invite/accept any assistance of fellow students, with the exception of borrowing authorized means, will be disqualified from taking further mid-term exams in the very semester as a consequence of their action. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission option. Final term-end results in courses with practical mark will automatically become Fail (1), the ones

with exam requirements will be labelled Refused Admission to Exams. (b). Those students whose homework verifiably proves to be of foreign extraction, or alternatively, evident results or work of a third party, are referred to as their own, will be disqualified from taking further assessment sessions in the very semester as a consequence of their action. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission options. Final term-end results in courses with practical mark will automatically become Fail (1), ones with exam requirements will be labelled Refused Admission to Exams. (c). Those students who apply unauthorized means (books, lecture notes, etc.), different from those listed in the course requirements and/or adopted by the lecturer in charge of the course assessment, in the written term-end exams taken, and/or invite/accept any assistance of fellow students, with the exception of borrowing authorized means, will immediately be disqualified from taking the term-end exam any further as a consequence of their action, and will be inhibited with an automatic Fail (1) in the exam. No further options to sit for the same exam can be accessed in the very same exam period. (d) Those students who alter, or make an attempt to alter the already corrected, evaluated, and distributed test or exercise/problem, i.) as a consequence of their action, will be disqualified from further assessments in the respective semester. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission options. Final term-end results in courses with practical mark will automatically become Fail (1), the ones with exam requirements will be labelled Refused Admission to Exams; ii.) and will immediately be inhibited with an automatic Fail (1) in the exam. No further options to sit for the same exam can be accessed in the very same exam period. 10. Retake and repeat 11. Consulting opportunities: Consultation hours: By email appointments 12. Reference literature (compulsory, recommended): · Books: W.D. Callister: Materials Science and Engineering (John Whiley and Sons, ISBN: 0-471-32013-7), D.C. Jiles: Principles of Materials Evaluation (CRC Press, ISBN: 13-978-0-8493-7392-3) · Downloadable materials: www.att.bme.hu 13. Home study required to pass the subject: Contact hours 28 h/semester Home study for the courses 28 h/semester Home study for the mid-semester checks 10 h/check Preparation of mid-semester homework - h/homework Home study of the allotted written notes 9 h/semester Home study for the exam 15 h/semester Totally: =90 h/semester 14. The data sheet and the requirements are prepared by: Name: Title: Affiliation (Department): Dr. István Mészáros associate professor Dept. of Materials Science and Engineering v\:* {behavior:url (#default#VML);} o\:* {behavior:url(#default#VML);} w\:* {behavior:url(#default#VML);} .shape {behavior:url (#default#VML);} /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-qformat:yes; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:10.0pt; font-family:"Times New Roman","serif";}

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTAGK1	Materials Science and Testing	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	AEa	English	MON:12:15-14:00(MT103); WED:10:15-12:00(MT103);

Main aims and objectives, learning outcomes of the subject: The aim of the course is to give a basic knowledge about the basis of materials science: what the basic physical, mechanical properties of the materials are, how they can be modified. The course also focuses on the materials testing methods, since these are the tools by which the materials can be characterized. The course mostly deals with metals and ceramics. Detailed thematic description of the subject: Week 1 Introduction, atomic structures. Week 2 Crystallography. Week 3 Crystal defects. Week 4 Diffusion. Solidification from molten state. Week 5 Thermal behaviour of metals and alloys. Week 6 Phase diagrams. The Fe-C diagram. Week 7 Non-equilibrium transformations of ferrous alloys. Week 8 Plastic deformation of single and polycrystals. Week 9 Methods to increase the strength of metals and alloys. Week 10 Creep, fatigue. Recrystallization. Week 11 Fracture mechanics. The effects of state variables. Week 12 Mechanical testing. Week 13 Fine structure investigations. Week 14 Magnetic and electric properties. Corrosion. Subject data sheet and requirements in english:
http://www.att.bme.hu/oktatas/BMEGEMTAGK1E/letoltes/Data_sheet_GEMTAGK1_Materials_Science_and_Testing.pdf

Subject code	Subject name	Requirement	ECTS credit
BMEGEPTAG0P	Polymer Materials Science and Engineering	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	E_ENGLISH	English	THU:08:15-10:00(MT_PTEA); THU:08:15-10:00(MT_PTEA); FRI:08:15-10:00(MT_PTEA);

The objective is to familiarize the students with the following subjects: structure of polymers; the dependence of their properties on structure, temperature and environment; the characteristics of their stressndash;strain relationships; their basic application, processing and recycling possibilities. Introduction on materials science and polymer engineering. Evolution of polymer engineering, main directions of its development and achievements. Application of polymers as structural materials. Molecular structure of polymers, structural levels. Polymerization techniques, building of macromolecules, 3D formations of macromolecules, solubility. Polymers classification, related applications and products. Morphology of polymers. Correlation between structure and mechanical properties in polymers. Time dependency of the mechanical properties, modeling the viscoelastic properties. The effect of environmental variables on the properties of polymers. Basics of melt rheology, flow and viscosity curves. Flow of polymer melts in capillaries and in slit dies. Measure of fluidity and viscosity. Flow deviations from steady state.

Polymer processing technologies, common steps of fabrication. Extrusion technology, extruder and related equipments, physical processes in the plastication unit, thermal conditions in the extruder, extruded products. Pipe extrusion die, coathanger sheet dies, extrusion blow molding, blown film extrusion, coextrusion. Film calendering. Bending of rolls, compensation possibilities. Improving the properties of films. Thermoforming of plastic sheets. Development and basics of injection molding technology. Reciprocating screw injection molding. The role, structure and types of the mold. Special (multicomponent) injection molding technologies. Synthetic fibers. Processing technologies of crosslinked polymers: hand lay-up method, filament winding, pultrusion, moulding compounds, prepregs. Processing of elastomers (rubbers) and related machines. Polymer matrix composites. Subjects of the laboratory practices: Tensile testing of polymers, Bending of polymers, Polymer composites, Thermoforming, Injection molding, Extrusion, Melt Flow Index, Rapid prototyping and Rapid Tooling. Url/details: http://www.pt.bme.hu/targyalapadat/44_BMEGEPTAG0P_targyleiras.pdf

Subject code	Subject name	Requirement	ECTS credit
BMEGEPTAGE1	Composites technology	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	L	English	MON:14:15-16:00(MT_PTLAB);
Lecture	E	English	MON:10:15-12:00(T200);

Main objective is getting familiar with the matrices and reinforcing materials of polymer composites. Gaining knowledge about the manufacturing technologies of thermoplastic and thermoset matrix composites. Learning the basics of composite mechanics and composite specific design guidelines. Topics: thermoset and thermoplastic composite matrix materials, properties and applications. Typical reinforcing materials of polymer composites. Reinforcing structures, properties and applications. Manufacturing technologies of thermoset matrix polymer composites: overview, typical products, tooling materials. Wet manufacturing technologies of thermoset matrix polymer composites: hand layup, spraying, RTM, pressing, pultrusion, filament winding, braiding, centrifugal casting. Dry manufacturing technologies of thermoset matrix polymer composites: autoclave curing of prepregs, out of autoclave prepreg curing, BMC pressing, SMC pressing, sandwich manufacturing. Manufacturing technologies of thermoplastic matrix polymer composites: extrusion, injection moulding, pressing, vacuum forming, GMT. Damage and failure of polymer composites: testing and approving methodologies. Basics of composite mechanics: types of material behaviour, rules of mixtures, laminate properties for different stacking sequences, composite plates under tension, composite plates under bending, failure criteria for composites. Example problem solving.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGA4SD	BSc Final Project	Mid-semester mark	15

Course type	Course code	Course language	Timetable information
Laboratory	AnL	English	

One-semester long individual project work. 10 hours/15 credits. * VG in the code stand for the supervising Department of Hydrodynamic Systems.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGAG02	Fluid Machinery	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	AnLpar	English	FRI:08:15-10:00(L-HIDROLAB);
Laboratory	AnLlan	English	FRI:08:15-10:00(L-HIDROLAB);
Lecture	AnE	English	WED:08:15-10:00(D327);
Practice	AnGypar	English	FRI:08:15-10:00(D327);
Practice	AnGylan	English	FRI:08:15-10:00(D327);

Main aims and objectives, learning outcomes of the subject: Upon finishing the course, the students will be able to design simple pumping systems, to select pumps and to complete simple pipe and valve sizing tasks. Moreover, they will become familiar with the operation and maintenance of such systems (e.g. head loss, cavitation, water hammer). Method of education: lecture: 2h/w seminar: 2h/2 weeks laboratory: 2h/2 weeks homework: measurement report submission Detailed thematic description of the subject: Euler equation, specific work, head, performance characteristics of axial and centrifugal machines. Losses, efficiencies. Non-dimensional parameters, scaling laws, specific speed. Cavitation, NPSH. Operation (parallel, serial) and control of turbomachines. Thrust loads (axial, radial). Axial fan, axial compressor stage.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGAG06	Independent Study 1.	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	AnL	English	

Independent Study 1 BMEGEVGAG06 One-semester long individual project work. 4 hours/4 credits.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGAG08	Individual project 2.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	AnL	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGMW02	Unsteady Flows in Pipe Networks	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	AnE	English	TUE:10:15-12:00(D515);

Overview of the program, introduction. Overview of applied numerical methods (Newton-Raphson, Runge-Kutta). 1D instationary flow of quasy-constant density fluid, MOC. Method of characteristics (realisation). Dynamics of air wessel. Dynamical model of pumps. Water hammer, transient pipe network simulation, homework. Open channel flow, basic equations. Lax-Wendroff scheme. Application of M

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGMW06	Hemodynamics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	AnE	English	TUE:12:15-14:00(D327);

Introduction to physiology. Circulation system, arterial and venous system. Blood flow measurement methods, invasive techniques. Non-invasive blood flow measurements, Transmission properties of cuff-systems, estimation of eigenfrequency. Introduction to the method of characteristics (MOC). MOC and Solution for rapid change, Alievi (Joukowsky)-wave. MOC and study of the transmission properties of invasive blood pressure measurement technique (arterial catheter). Models and methods for the de scription of blood flow in blood vessels, material properties, Streeter-Wiley Model 1 and Model 2. Characteristic physiological quantities and their influence in hemodynamics.Flow in aneurysms.