BULLETIN

Budapest University of Technology and Economics

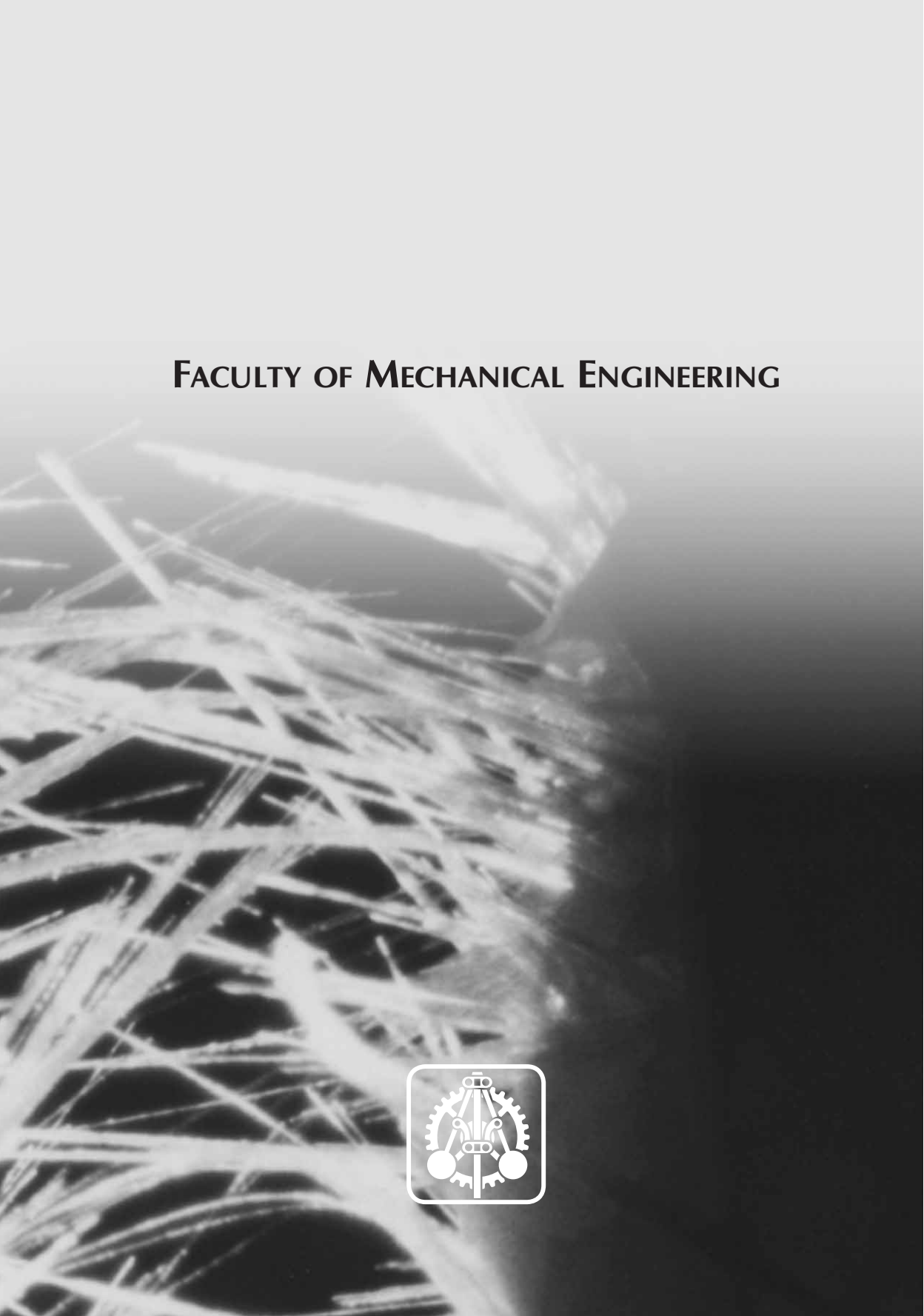
2006–2007

An ECTS Guide

Engineering Programs in English

http://www.tanok.bme.hu

Faculty of Mechanical Engineering



The Mechanical Engineering Program at the Budapest University of Technology and Economics began in 1863, and the Faculty of Mechanical Engineering was established soon afterward, beginning official operations in the 1871/72 academic year. The Faculty is justly proud of its continuous and progressive 120-year history and now offers undergraduate and graduate programs in both Hungarian and English.

Since the 1985/86 academic year, the Faculty of Mechanical Engineering has offered a four-year undergraduate B.Sc. degree program in English. The two-year graduate program in English, leading to an M.Sc. degree in refrigeration and air conditioning or production engineering, was launched in September 1989. Another way to earn M.Sc. degree is to enrol into the Integrated Engineering Course, offered since 1996/97. The course includes essential subject areas of materials and software engineering, advanced mechanics, manufacturing, analogue and digital electronics instrumentation, microprocessors, management, marketing and finance. Integrated engineers operate at higher level than specialists, they integrate hardware and software products of various specialists into complex, multi-functioning, intelligent systems. Individual postgraduate academic and research programs, which are usually completed in two to three years, are available for those who already have an M.Sc. degree and wish to pursue a Ph.D. degree.

The undergraduate B.Sc. program of the Faculty of Mechanical Engineering is designed to continue a tradition of excellence by:

- providing a well-grounded and broad knowledge that graduates of this Faculty can apply immediately in their work and also use as the basis for further studies; and
- graduating competent engineers who are not only masters of their profession, but also possess an ethical philosophy of engineering based on accuracy, punctuality and reliability as well as a respect for the human element.

The goals of the Faculty's graduate M.Sc. and Ph.D. programs are:

- to train creative, inventive mechanical engineers who can apply the engineering skills and the knowledge they have gained from the natural sciences on a state-of-the-art level; and
- to foster the development of leaders in engineering research and development.

Departments

Process Engineering,
Heat Engines,
Energy Engineering,
Fluid Mechanics,
Hydrodinamic Systems,
Manufacturing Engineering,
Applied Mechanics,
Mechatronics, Optics and Instrumentation Technology,
Building Service Engineering,
Production Informatics Management,
Polymer Engineering.

Institutes

Machine Design
(Departments of Agricultural Machine Design, Machine Elements),
Mechanical Technology and Materials Science
(Departments of Electrical Materials Technology, Mechanical Technology).

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Faculty of Mechanical Engineering
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Dean of the Faculty: Prof. Dr. Antal Penninger
Vice-Dean of the Faculty: Dr. László Kocsis
Course Director: Dr. Attila Kovács
Program Co-ordinator: Mrs. Ildikó Lente

Curriculum of B.Sc. Subjects

Subject			Working hours / semester								Requisites
Name	Code	Credits	1	2	3	4	5	6	7	8	
English Language I	BMETKGTB101	0	6								e
Descriptive Geometry	BMEGE90AX06	3	3								e
English Language II	BMETKGTB201	0		6							e
Engineering Science	BMEGEVGAG01	4	4								e
English Language III	BMETKGTB301	0			4						e
Information Systems	BMEGERIA311	4	4								s
English Language IV	BMETKGTB401	0				4					e
Macro- and Microeconomics	BMEGT30A001	4	4								e
Mathematics A1-Calculus	BMETE90AX00	6	6								e
Technical Chemistry	BMEVEKTAGE1	3	3								s
Statics	BMEGEMMAGM1	3	2								s
Economic Subject		2	2								s
Materials Science	BMEGEMTAGA1	6		5							e
Introduction to CAD	BMEGEGEAOCD	4		3							s
Physics A2	BMETE15AX02	2		2							e
Fundamentals of Machine Design	BMEGEGEAGM1	4		4							s
Mathematics A2 - Vector Functions	BMETE90AX02	6		6							e
Software Engenieering	BMEGERIA32P	2		2							s
Strenght of Materials	BMEGEMMAGM2	5		4							e
Economic Subject		2		2							s
Dinamics	BMEGEMMAGM3	5			4						e
Materials Engineering	BMEGEMTAGA2	4			4						e
Physics A3	BMETE15AX03	2			2						s
Machine Elements and Design 1.	BMEGEGEAGG1	5			4						e
Environmental Management Systems	BMEGT42KO14-01	3			3						s
Mathematics A3 for Mechanical Engineers	BMETE90AX10	4			4						s
Management and Business Economics	BMEGT20A001	4			4						s
Business Law	BMEGT55A001	2			2						s
Probability Theory and Statistics		2			2						e
Basis of Electrical Engineering	BMEVIAUA007	3				3					s
Machine Elements and Design 2.	BMEGEGEAGG2	6				5					e
Manufacturing	BMEGEGTA601	5				5					e
Measurement and Signal Processing	BMEGEMOAG01	4				4					s
Engineering Thermodynamics	BMEGEENAEG1	3				3					e
Polymers	BMEGEPTAGOP	6				5					e
Vibrations	BMEGEMMAGM4	4				3					s
Fluid Mechanics	BMEGEATAGO1	5					5				e
Electro-mechanical Systems	BMEVIAUA008	4					4				e
Control Engineering	BMEGERIA35I	5					5				e
Heat Transfer	BMEGEENAEG2	3					4				s
Numerical Simulation of Fluid Flows	BMEGEÁTAGO6	2					2				s
Diffusion Processes	BMEGEVÉAG02	2					2				e
Energy and Env. Protection. Meas.	BMEGENAG51	3					3				s
Air poll. Wastewater and Solid Wastes Man.	BMEGEÁTAG04	3					3				s
Technical Acoustics and Noise Control	BMEGEÁTAG05	3					3				s
Fluid Machinery	BMEGEVGAG02	4						4			e
Heat Engines	BMEGEENAEGK	4						4			e
Measurement Technique of Processes	BMEGEVGAG03	2						2			s
Processes and Equipment of Chemical Ind.	BMEGEVÉAG03	5						5			e
Introduction to the Finite Element M.	BMEGEMMAG05	3						3			s
Production Engineering		4						3			e
Air Conditioning and Refrigeration I.		4						4			s
Hydrodynamics Systems	BMEGVEVGAG05	3							3		e
Energy Processes and Equipments	BMEGEENAG71	5							5		e
Volumetric pumps and compressors	BMEGEVGAG04	2							2		e
Meas. Techniques for Chem. and Env. Proc.	BMEGEVEAG04	3							3		s
Air Conditioning and Refrigeration II.		4							4		e
Project		15							15		

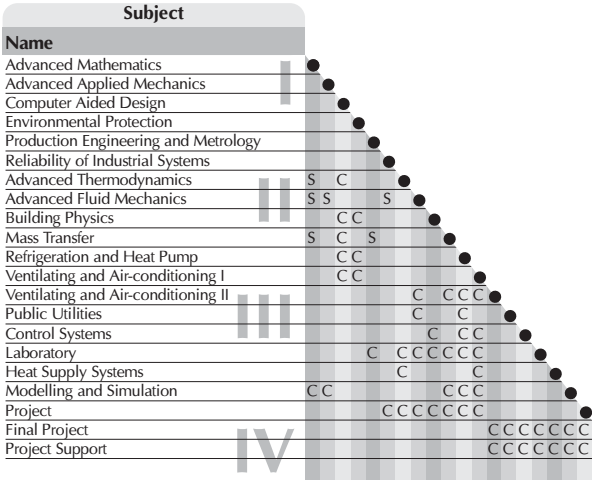
Curriculum of M.Sc. Subjects

Subject			Working hours / semester				Requisites
Name	**Code**	**Credits**	**1**	**2**	**3**	**4**	
Branch of Air-Conditioning and Refrigeration							
Advanced Mathematics	BMETKGEM101	5	4				e
Advanced Applied Mechanics	BMETKGEM102	6	6				e
Computer-Aided Design	BMETKGEM103	5	4				p
Environmental Protection	BMETKGEM104	3	3				e
Production Engineering and Metrology	BMETKGEM105	5	4				e
Reliability of Industrial Systems	BMETKGEM106	3	3				e
Advanced Thermodynamics	BMETKGEM201	4		4			e
Advanced Fluid Mechanics	BMETKGEM202	4		3			e
Mass Transfer	BMETKGEM203	5		4			e
Building Physics	BMETKGEM204	4		4			e
Refrigeration and Heat Pump	BMETKGEM205	6		6			e
Ventilating and Air-conditioning I	BMETKGEM206	4		3			e
Ventilating and Air-conditioning II	BMETKGEM301	5			5		e
Public Utilities	BMETKGEM302	3			3		e
Control Systems	BMETKGEM303	4			3		e
Laboratory	BMETKGEM304	4			4		p
Heat Supply Systems	BMETKGEM305	3			3		e
Modeling and Simulation	BMETKGEM306	5			4		e
Project	BMETKGEM307	3			2		p
Final Project	BMETKGEM401	24				8	
Project Support	BMETKGEM402	6				6	s
Branch of Production Engineering							
Advanced Mathematics	BMETKGEM101	5	4				e
Advanced Applied Mechanics	BMETKGEM102	6	6				e
Computer-Aided Design	BMETKGEM103	5	4				p
Environmental Protection	BMETKGEM104	3	3				e
Production Engineering and Metrology	BMETKGEM105	5	4				e
Reliability of Industrial Systems	BMETKGEM106	3	3				e
Manufacturing Process Planning	BMETKGEM207	4		4			e
Advanced Material Sciences	BMETKGEM208	5		4			e
Machine Tools and Industrial Robots	BMETKGEM209	5		4			p
Advanced Metal Forming	BMETKGEM210	5		6			e
Fatigue and Fracture of Structural Materials	BMETKGEM211	3		2			e
Computer-Aided Quality Assurance	BMETKGEM212	5		4			p
Computer-Aided Production Engineering	BMETKGEM308	5			6		p
Advanced Welding Technology	BMETKGEM309	4			4		e
Weldability and Testing of Welded Construction	BMETKGEM310	3			2		e
Computer-Integrated Manufacturing	BMETKGEM311	5			4		e
Tool and Die Design	BMETKGEM312	4			4		p
Forming and Forging Machines	BMETKGEM313	3			2		e
Project	BMETKGEM307	3			2		p
Final Project	BMETKGEM401	24				8	s
Project Support	BMETKGEM402	6				6	p
Integrated Engineering M.Sc. Course - Mechanical Engineering Subjects							
Mechanical Drives	BMETKGEM107		3 e 3				
Materials Engineering (*)	BMETKGEM213		4 e 5				
Dynamics of Machines	BMETKGEM214			2 e 3			
Advanced Flow Measurements	BMETKGEM215			2 e 3			
CIM Technology	BMETKGEM314				3 e 4		
CAD Technology (*)	BMETKGEM315				4 e 5		
Near Net Shaping (*)	BMETKGEM316				4 e 5		
Information Management	BMETKGEM317				3 s 3		
Structural Analysis	BMETKGEM318				3 s 3		
Integrated Engineering M.Sc. Course - Electrical Engineering Subjects							
Analog Informatics	BMETKGEM108		2 e 3				
Analog Informatics	BMETKGEM216			2 e 2			
Digital Informatics (**)	BMETKGEM109		2 e 3				
Digital Informatics (**)	BMETKGEM217			4 e 5 (**)			
Power and Motion Control	BMETKGEM112		2 e 3				
Power and Motion Control	BMETKGEM218			5 e 6			
Integrated Measurements (**)	BMETKGEM319				4 e 5		
Microelectronics and Microsystems (**)	BMETKGEM320				4 e 5		
Integrated Engineering M.Sc. Course - Joint Mechanical/Elect. Subjects							
Laboratory	BMETKGEM113		6 s 5				
Integrating Project	BMETKGEM219			4 s 6			
Integrating Project	BMETKGEM321				4 s 6		
Marketing	BMETKGEM110		3 e 4				Management Subjects
Production Management	BMETKGEM220			3 s 3			Management Subjects
Optional Subjects			3 s 4	2 e 2	3 e 4		
Total			25 / 30	24 / 30	24 / 30		
Software Informatics	BMETKGEM322				3 e 4		Recommended Optional Subj.
Human Resource Management	BMETKGEM111		3 s 4				Recommended Optional Subj.
Finance	BMETKGEM221			2 e 2			Recommended Optional Subj.

Meaning of table data:
"7 e 9" .... contact time (CT) hours/week - credit points (CP)
assessment:
"e" = exam;
"s" = semester mark (based 100 % on course work)

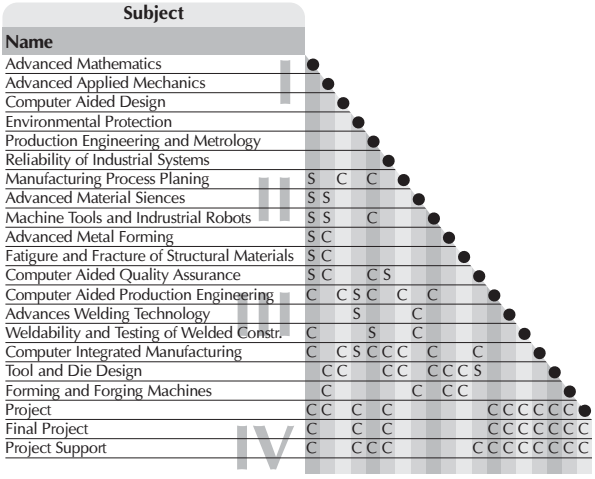
(*) / (**) Compulsory optional mechanical / electrical subjects (two of each group are compulsory).

Pre-Requisites
Air Conditioning and Refrigeration M.Sc. Course A



C: Credit required
S: Signature required

Pre-Requisites
Production Engineering M.Sc. Course B



C: Credit required
S: Signature required

Description of B.Sc. Subjects

Descriptive geometry

BMETE90AX06

Dr. Márta Szilvási-Nagy, Dr. Gábor Molnár-Sáska

Mutual positions of spatial elements. Orthogonal projections in Monge's representation, auxiliary projections. Intersection of polygons and polyhedra. True measurements of segments and angles. Perpandicular lines and planes. Projection of the circle. Representation of rotational surfaces and their intersections with a plane. Axonometric view. Construction of the helix. (3 hours/3 credits)

Engineering Science

BMEGEVGAG01

Dr. Attila Kovács, Dr. Gábor Halász

Some definitions for machines. Basic and derived quantities. Transmission of mechanical work. Losses and efficiency. Uniformly accelerated motion of machines. Motion graphs. Absolute and gauge pressure. Bernoulli's equation. Venturi meter. Linear and rotational analogues. Thermal energy. The specific heat capacity and latent heat. Error limit. Balance machines. Orifice and volume meter tand. Measuring pressure and moment of inertia. (4 hours/4 credits)

Information Systems

BMEGERIA311

Dr. László Monostori

Introduction to informatics. Computer structures. Operating systems. Computer networks - Internet. Theoretical and practical data structures. Algorithms. Computer programs, program design, programming methods, program structures. Programming languages: basics, data types, variables, programming structures. Programming languages: subroutines and modules. Data bases: Relational data bases, normalized database design. Data bases: the SQL language. Basics and algorithms of computer graphics. (4 hours/4 credits)

Macro- and Microeconomics

BMEGT30A001

Dr. Edit Romvári

Introduction to macroeconomics. Output and aggregata demand. Fiscal policy and foregn trade. Money and banking. Interest rates and monetray transmission. Monetray and fiscal policy. Aggregate supply, prices and adjustment to shocks. Inflation, expectations, and credibility. Unemployment. Exchange rates and the balance of payments. Economic growth. Economics and the economy. Tools of economic analysis. Demand, supply and the market. Elasticities of demand and supply. Consumer choice and demand decisions. Introducing supply decisions. Costs and supply. Perfect competition and pure monopoly. Market structure and imperfect competition. The labor market. Factor markets and income distribution. (4 hours/4 credits)

Mathematics A1 - Calculus

BMETE90AX00

Dr. Péter Moson

Algebra of vectors in plane and in space. Arithmetic of complex numbers. Infinite sequences. Limit of a function, some important limits. Continuity. Differentiation: rules, derivatives of elementary fuctions. Mean value theorems, l'Hospital's rule, Taylor theorem. Curve sketchig for a function, local and absolute extrema. Integration: properties of the Riemann integral, Newton-Leibniz theorem, antiderivatives, integration by parts, integration by substitution. Integration in special classes of functions. Improper integrals. Applications of the integral. (6 hours/6 credits)

Technical Chemistry

BMEVEKTAGE1

Dr. Gábor Bajnóczy

Thermodynamics of chemical reactions. Reaction kinetics and catalysis. Chemical equlibriums. Electrochemistry, galvanic cells, eletrochemical corrosion. Principles of combustion. Coal types and coal combustion. Petroleum and petroleum refining. Petroleum products. Automotive fuels. Lubrication and lubricants. Water for industrial use. Environmental protection in chemical engineering. Laboratory practices. (3 hours/3 credits)

Statics

BMEGEMMAGM1

Dr. Ádám Kovács

Force, moment, force-couple. Fixed vector systems. Reduction of a force system. Equilibrium equations. Rigid body. Centroid. Plane constraints. Trusses. Method of joints and method of section. Combined plane structures. Principle of superposition. Stress resultants. Stress resultant diagrams and functions. Coulomb-friction. Belt friction. Rolling resistance. (2 hours/3 credits)

Materials Science

BMEGEMTAGA1

Dr. György Krallics

Atomic structure and inter-atomic bonding. The structure of crystalline solids. Crystallography. Imperfections in solids. Mechanical properties of metals. Diffusion. Phase diagrams. Phase transformation in metals. Recrystallization, precipitation hardening, strain hardening, solid solution hardening. Failure mechanism, fatigue, creep fracture. Basics of fracture mechanics. Failure case studies. (5 hours/6 credits)

Introduction to CAD

BMEGEGEAOCD

Dr. Károly Váradi

Definitons of CAD, CAM and CAE. Sequential engieneering. Concurrent Engineering. Integration of CAD, CAM and CAE through database. The concurrent engineering process. The product model formed from aspect models. Product data management (PDM) systems. Component of CAD/CAM/CAE systems. Hardware configurations for CAD/CAM/CAE systems. Computer graphics. Typical graphics operations. Geometric modelling. Feature based modelling. Parametric modelling. CAD/CAM databases. (3 hours/4 credits)

Physics A2

BMETE15AX02

Dr. Sándor Kugler

Properties of electric charges. Insulators and conductors. Coulomb's law. The electric field. Superposition. Electric field lines. The electric flux. Gauss's law. Examples: the electric field od some specific charge distributions. The electric filed inside and outside of conducting materials. Work and the electric potential. Capacitance and dielectrics. The electric current in various media. Microscopic interpretation of current density and resistivity. Classical and differential Ohm's

law. Resistance and energy dissipation. Resistance and temperature. Low temperature behavior of conductors. Footprints of quantum mechanics: residual resistivity, superconductors, semiconductors. Batteries, electromotive force, internal resistance. Magnetic fields. The Lorentz law. Sources of magnetic fields. The non-existence of megnetic monomoles. The Biot-Savart law. Ampere's law. Examples: the magnetis field of some specific current distributions. Forces acting on current carrying conductors. Torque, magnetic moment, spin. Electric motor. The microscopic structure of ferromagnets. Faraday's law of induction. Generators, transformers. Inductance, self-inductance. Energy stored in magnetic fields. Displacement current, generalized Ampere's law. Maxwell's equations of the electromagnetic field. Electromagnetic waves. Properties of radio, infrared, visible, ultraviolet, X-ray and gamma radiation. (2 hours/2 credits)

Fundamentals of Machine Design

BMEGEGEAGM1

Dr. Sándor Balku Bisztray

Projections. The orthographic drawing and sketching. Arrangement of views. Auxiliary and sectional views. Dimensions, notes, limits and accuracy. Representations of threaded parts, and threaded fasteners, gears, splines and keys. Drawign for engineering designamd construction (detail, assembly and other drawigns). Detail drawings of simple machine elements (stuffing box cover; clevis pin). Assembly drawing and partial assembly of the elements mounted on shafts (belt pulley assembly; shaft with bearings; stuffing box assembly). Set of working drawings of a valve (workong sketches by freehand; pencilling of detail and assembly drawings). (4 hours/4 credits)

Mathematics A2 - Vector Functions

BMETE90AX02

Dr. Péter Moson

Solving systems of linear equations: elementary row operations, Gauss-Jordan- and Gaussian elimination. Homogeneous systems of linear equations. Arithmetic and rank of matrices. Determinant: geometric interpretation, expansion of determinants. Cramer's rule, interpolation, Vandermonde determinant. Linear space, subspace, generating system, basis, orthogonal and orthonormal basis. Linear maps, linear transformations and their matrices. Kernel, image, dimension theorem. Linear transformations and systems of linear equations. Eigenvalues, eigenvectors, similarity, diagonalizability. Infinite series: convergence, divergence, absolute convergence. Sewuences and series of functions, convergence criteria, power series, Taylor series. Fourier series: axpansion, odd and even functions. Functions in several variables: continuity, differential and integral calculus, partial derivatives, Young's theorem. Local and global maxima/minima. Vector-vector functions, their derivatives, Jacobi matrix. Integrals: area and volume integrals. (6 hours/6 credits)

Software Engieering

BMEGERIA32P

Dr. László Monostori

Modern programming methods. Object oriented programming. Usage of components. Working with rapid application development environments. Structure of Windows applications. Components of Windows programs, elements of supporting program languages, data types, conversions, structures, parameter passing. Event based multitasking strategies. Computer graphics. File management. Databases. (2 hours/2 credits)

Stength of Materials

BMEGEMMAGM2

Dr. Ádám Kovács

Stress state and strain state in linear elastic bodies. Simple tension and compression. Simple Hooke's law. Area moments of inertia. Bending. Torsion. Combine loads: tension and bending, shear and bending. Bending of curved plane beams. Principal stresses and strains. Mohr's circles. Eigenvalues 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). Euler's theory of slender beams. Stacally indeterminate structures and frames. Thin pressure vessels, - theory of membranes. (4 hours/5 credits)

Dynamics

BMEGEMMAGM3

Dr. Gábor Stépán

Kinematics and kinetics of a particle. Constrained motion. Dynamics of a set of particles. Plane kinematics of rigid bodies. Relative kinematics. Plane kinetics of rigid bodies. Mass moments of inertia. Work and power theorems. Kinetic energy. Central and eccentric impact. General plane motion. Rotation about a fixed axis. Static and dynamic balancing. (4 hours/5 credits)

Materials Engineering

BMEGEMTAGA2

Dr. Béla Palotás

Production technologies of Materials. Connection between the structure and properties of materials. Iron and steel making technologies. Basics of plastic deformation and technologies. Hot working, semi-hot working. Effects of alloying elements on steels. Classification of steels. Welding processes. Casting and molding processes for ferrous alloys. Ceramics and metal matrix composites. Materials selection. (4 hours/4 credits)

Physics A3

BMETE15AX03

Dr. Sándor Kugler

Statistical thermodynamics, Definitions. The kinetic theory of gases. Pressure, temperature, etc. Statistical physics. Probabilities. Statistical description of many-body systems. Specification of the states of a system. Ideal gases. Maxwell velocity distribution. Boltzmann distribution. Statistical temperature. Entropy. Atomic physics. Blackbody radiation. Photoelectric effect. Compton Scattering. Spectral lines of atoms. Franck-Hertz experiment. Bohr's model of hydrogen. Fission and fusion of atoms. Schrödinger equation. Introduction to solid state physics. Electronic properties of solid states. (2 hours/2 credits)

Machine Elements and Design 1

BMEGEGEAGG1

Dr. Károly Váradi

Design principles, loading cases, critical conditions, safety factor. Joints. Classification. Bolted jionts. Threaded fasteners. Applications. Thread profiles. Bolt selections. Torque calculation. Bolt tightening. Power screws. Riveted joint. Elastic cushion (spring) model. Welded joint. Types, loading. Stress calculation. Shaft ang hub joints. Torque transmission joints (key, flat key, spline). Interference fit. Transmittable torque. Cylindrical and taper joints. Elements of pipe networks. Pipe fittings. Pressure vessels. Standard and optimal design. Gaskets and Seals. High pressure, temperature and speed applications. Springs. Steel and rubber springs. Functional

and stress design. Shafts and rotors. Stress analysis of shafts and rotors for static combined loads. Fatigue and life of members. Dimensioning on strength at harmonically varying loads. (4 hours/5 credits)

Environmental management systems

BMEGT42KO14-01

Dr. Kálmán Kósi, Dr. Mihály Parti

The course covers the topics relavant to the protection of environmental compartments, environmental pressures and pollution in a global context. Introduces the concepts, indicators and tools of environmental protection (air, water noise and soil protection and waste management. Environmental management systems (EMS) at enterprises and other organizations. EMS topics include the assessment of environmental aspects and impacts, environmental audit, reporting, environmental performance evaluation, life cycle assessment and related international standards. (3 hours/3 credits)

Mathematics A3 for Mechanical Engineers

BMETE90AX10

Dr. Péter Moson

Classification of differential equations. Separable ordinary differential equations, linear equations with constant and variable coefficients, systems of linear differential equations with constant coefficients. Some applications of ODEs. Scalar and vector fields. Line and surface integrals. Divergence and curl, theorems of Gauss and Stokes, Green formulae. Conservative vector fields, potencials. Some applications of vector analysis. Software applications for solving some elementary problems. (4 hours/4 credits)

Management and Business Economics

BMEGT20A001

Dr. János Kövesi

Intended for engineering students who would like a better conceptual understanding of the role of management int he decision making process. This course introduces the essentials of management as they apply within the contemporary work environment. Particular attention is paid to management theories, corporate finance, leadership, teamwork, quality management, management of technology, economics calculation and operations management. For problem formulation both the managerial interpretation and the mathematical techniques are applied. (4 hours/4 credits)

Businnes Law

BMEGT55A001

Dr. János Verebics

The problems of the area will be treated in two major parts. Part One introduces students to the general topics, for example the concept of law, the functions of the law in the socieconomic life. Some basic legal problems, like the conception, characteristics and functions of the modern state and, in a comparative view, the characteristics of the Anglo-Saxon and continetal systems of business law and the development of the Hungarian business law will be also discussed. The emphasis of Part Two is on the questions of company law and competition law presented in a European context. The lectures of this part outline not only the regulations of the Hungarian Company Act and Company Registry Act but they cover EU directives and regulations on companies and competition as well. (2 hours/2 credits)

Probability Theory and Statistics

Dr. Tamás Szántai, Dr. Gergely Mádi-Nagy

Kolmogorov's axioms. Elementary properties of probability. Condition probability, independence of events. Random variables, distribution function, probability density function. The binomial geometric, hypergeometric, uniform, exponential, normal, student's, c2-and Fisher's distributions. Expectation and variance. Covariance and correlation coefficient. Markov's and Chebishev's inequalities. The law of large numbers. Central limit theorem. Element of statistics. Hypotheses and tests (u-, t-, F- and c2-tests). Regressions. (2hours/2 credits)

Basis of Electrical Engineering

BMEVIAUA007

Peter Korondi Ph.D.

Flux and potential difference, Electromotive force and potential difference, Concept of lumped parameter, Stationary current and basic circuit principles, Electomagnetic field in material and magnetic circles, Modeling electromechanical systems, Basic electrical instruments and measurements, Applications. (3 hours/3 credits)

Machine Elements and Design 2

BMEGEGEAGG2

Dr. Sándor Balku Bisztray

Fundamentals of tribology. Friction, wear and lubrication. Bearings. Sliding (plain) bearings. Designing hydrodynamic and hydrostatic bearings. Rolling bearings, dimensioning for life and static loading. Indirect drives. Friction and belt drives. Chain drives. Gear drives, geometry and strength. Drives for big gearing ratio: worm gea-, planetary gear-, harmonic gear- and cycloid gear drives. (5 hours/6 credits)

Manufactoring

BMEGEGTAG01

Dr. Tibor Szalay

The basic model of the machinig system (WFMTC system), introduction to the part modeling, to the fixturing the parts, to the machine tools and robotics, to the cutting tools and to the controlling of the machine tools. Mechanics of cutting, geometry of the cutting edge, chip breaking, stability of cutting. Tool wear and tool life. Tool materials and cutting fluids. Fundamentals of the measuring techiques and quality control. The main measuring devices. Fundamentals of metal cutting machine tools kinematics. Manually operated, cam controlled and computer controlled machine tools. Basoc types of machine tools. Flexible manufacturing cells and systems. Workshop training. (5 hours/5 credits)

Measurement and Signal Processing

BMEGEMOAG01

Dr. Antal Huba, Dr. Gábor Halász

History of measuring technique, the role of metrology in mechanical engineering. Measurement as modeling process, contruction of measuring system, measuring methods. How to measure (choosing measuring method and equipment). Source of measurement errors and reducing of their influence. Characteristic quantities of measuring equipments for steady and unsteady measurements, sensitivity, resolution. Basics of probability and mathematical statistics, usage in measuring technique. Estimation of measurement errors. Direct and indirect methods of measuring of steady signals, error spreading. Calibration and linear regression. Correlation and its applications. Polynomial curve fitting, Wald-method, smoothig spline. (4 hours/4 credits)

Engineering Thermodynamics

BMEGEENAEG1

Dr. Gyula Gróf, Dr. Csaba Horváth

Basic conceptrs. 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, atmospheric (moisten) air. (3 hours/3 credits)

Polymers

BMEGEPTAGOP

Dr. Tibor Czvikovszky

The main goal of the Materials Science and Engineering II is to introduce the students to the polymers as structural materials with emphasis on their differences from traditional engineering materials. The role of polymers in the engineering materials. Classification of polymers, thermoplastics and thermosets, Crystal structure and morphology. Mechanical, dynamic mechanical and thermo-mechanical behavior of polymers. Melt-rheology of thermoplastics. Polymer melts as non-Newtonian viscous liquids. Flow of polymer melts in tubes and rectangular ducts. Extrusion of thermoplastics. Manufarcturing of polymer sheets on calanders. Polymer processing technologies of complex 3D parts and products. Main parts and function of reciprocating screw-injection molding machines. Thermoforming. Processing technologies of thermosets. Rubber technology. Processing technologies of high strength, reinforced polymer composites. (5 hours/6 credits)

Vibrations

BMEGEMMAGM4

Dr. Gábor Stépán

Single degree-of-freedom vibrating systems. Free, indamped vibrations. Pendula. Damped vibrations (dry friction, viscous damping). Forced vibrations, isolation of vibrations. Several degrees-of-freedom systems. Langrange-equation of the second kind. Natural frequencies and vibration modes. Model analysis. Energy and numerical methods (Rayleigh-Stodola, Dunkerley). Vibration of one dimensional continuous systems (longitudinal, torsional, bending vibrations). Vibration measuring methods. (3 hours/4 credits)

Fluid Mechanics

BMEGEATAG01

Dr. Tamás Lajos

Properties of fluids. Ideal incompressible fluid. Transport equation. Continuity, momentum law, Bernoulli's equation. Moment of momentum, Euler's turbine equation, airscrew, windmill. Viscous effects. Laminar and turbulent flow. Navier-Stockes equation. Boundary layer, separation of flow. Dimensional analysis. Forces on submerged bodies, drag, lift. Flow in pipes and channels. Pipe network. Compressible flow in pipes. Velocity of sound, mach number. Laval nozzle. Shock wave. Acoustics. Wave equation. Levels (decibel), propagation of sound waves. Vorticity, Helmholts' laws. (5 hours/5 credits)

Electro-mechanical Systems

BMEVIAUA008

Peter Korondi Ph.D.

Alternating Quantities, (AC circuits). Complex calculation method and phasor diagram. Active, reactive and apparent powers. Transient phenomena, Three and multi-phase systems. Transformers. Rotating magnetic field. Asynchronous, synchronous, DC and special machines. Motor selection. (4 hours/4 credits)

Control Engineering

BMEGERIA351

Dr. Petra Aradi

Methods of system analysis. Modelling and analysis of linear systems. Non-linear systems, linearization methods, soft computing approaches. Stability analysis. Synthesis of systems. Simulation as the tool for operating mathematical models. Simulation methods and software for engineering applications. Control and ist classification (open-loop and feedback control). Linear feedback control systems. Compensation methods: serial compensation, compensation with feedback, multi-loop control systems. Optimal control. (5 hours/5 crecits)

Heat Transfer

BMEGEENAEG2

Dr. Gyula Gróf, Dr. Csaba Horváth

Basic forms of heat transfer. Fundamental equations. General differential equation of heat conduction. Steady state and transient contuction. Thermal resistance. Extended surfaces, fin performance. Continuously operating heat sources. Numerical methods. Convection; concepts and basic relations, boundary layers, similarity concept. Free convection, forced convection, boiling and condenstion. Empirical formulas. Dimensioning of heat exchangers, efficiency. Radiation heat transfer. (4 hours/3 credits)

Numerical Simulation of Fluid Flows

BMEGEATAG06

Dr. Gergely Kristóf

Overview of numerical methods used in fluid mechanics. Conservation form of transport equations. Fundamental concept of finite volume method. Numerical approximation of fluxes, upwinding methods. Solution of pressure-velocity coupling int he case of incompressible flows. Solution methods for Poisson equation. Turbulent models: Reynolds averaged approximation, zero-, one- and two-equation models. Boundary layers, boundary conditions of turbulent models. Direct solution of Navie-Stokes equation and Large Eddy Simulation. Compressible flow models. One-dimensional time dependent flows pipe systems. Errors and uncertainties in numerical models. (2 hours/2 credits)

Diffusion Processes

BMEGEVÉAG02

Dr. Károly Molnár

Intoduction to mass transfer. Phenomenological theory of molecular diffusion. Turbulent diffusion, mass transfer in turbulent flow. Analogies between mass, heat and momentum transfer. Two-film (Lewis-Whitman) theory. Principles of mass transfer in packed and tray columns. Case studies of heat and mass transfer in environmental protection and energetics problems. (2 hours/2 credits)

Energy and Environment Protection Measurements

BMEGENAG51

Dr. Ákos Bereczky

The role of measurements in maintaining and controlling the energy conversation processes. Hardware and software tools of the control and measurement systems. Laboratory tests of different engines and equipments. Simultaneous determination of system variables (flow rates, pressures, temperatures etc.). Methods of determination of performance, efficiency, exhaust gas composition. (3 hours/3 credits)

Air Pollution, Wastewater and Solid Wastes Managemet

BMEGEÁTAG04

Dr. Mihály Parti

Gaseous and particulate air pollutants. Source control of emissions. Waste gas treatment techiques for volatile organic compounds and inorganic compounds, for gaseous pollutats in combustion exhaust gases and for particulate matter. Wastewater characteristics, pre-treatment. Primary separation or clarification wastewater treatment techniques. Physica-chemical watewater treatment techniques. Biological treatment techiques for biodegradable waste water. Wastewater sludge treatment techniques, sludge disposal. Types, sources, properties, quantities, and qualities of solid wastes. On-site handling, storage and processing of solid wastes. Collection, transfer and transport of solid wastes. Solid wastes processing techniques. Biological, chemical and energetic resource recovery processes. Ultimate disposal. (3 hours/3 credits)

Technical Acoustics and Noise Control

BMEGEÁTAG05

Dr. Gábor Koscsó

Concept of acoustics, classification of the subject. The concept of sound, two-fold nature of sound. Linear acoustic model, and speed of sound. Homogeneous wave equation, general solution, solutions in bounded space. Harmonic waves, trigonometric and complex representation. Model testing and similitude, Helmhotz-number. Standing wave and beat. Helmholtz-resonator. Harmonic analysis, sound spectra, octave band. Energetical relations of acoustic waves. Kinetic and potential energy density, sound intensity, sound power, RMS value and levels. Calculation with levels. Transmission loss, insertion loss, noise reduction. Impedances. Spherical waves, sound sources, monopole, dipole and quadrupole radiators. Far field approximation of point and line sources in free field, sound propagation in the atmophere. Attenuation of sound waves. Normal transmission from one medium to another, and transmission of obliquely incident sound waves. Transmission loss of one-layer wall. Sound propagation in duct and higher order modes. The energetical model of closed sound space. Direct and reverberant sound fields. Room constant. The subject of noise control. Physiological effects of noise. Subjective measurement units, phon, dB(A), equivalent sound pressure level. The general methodology aof noise control. Sound waves generated by mechanical, fluid mechanical and thermal processes and their reduction. Noise control in free and in bounded space. Personal noise protection. Acoustic measurements, microphones, analysers, calibrators, anechoic and reverberating chambers. (3 hours/3 credits)

Fluid Machinery

BMEGEVGAG02

Dr. László Kullmann

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. (4 hours/4 credits)

Heat Engines

BMEGEENAEGK

Dr. Antal Penninger

Fuels, fuel technology. Different type of boiler constructions. 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 operation. Environmental aspects. (4 hours/4 crecits)

Measurement Techique of Processes

BMEGEVGAG03

Dr. Gábor Halász, Dr. Zoltán Pandula

Physical quantities (shift, revolution number, force, torque, temperature, pressure, flow rate, etc.) of processes and their measurements. Basics of probability and statistics. Noise as stochastic process variable. Density and distibution function, correlation and autocorrelation. Fourier-transformation in data processing, spectrum, detection periodic signals and noise. Measurement of time dependent quantities, digital sampling. Curve fitting, confidence interval, estimation of measurement error. Data acquisition and data processing, calibration of pressure transducer, water-meter. Measurements of characheristics of machines. Failure detection with vibration measurements, analysis of periodic and noisy pressure signals. (2 hours/2 credits)

Processes and Equipment of Chemical Industry

BMEGEVÉAG03

Dr. Károly Molnár

Theory of liquid mixing. Mixers for low- or medium-viscosity kiquids. Separation of gas-solid and liquid-solid systems. Settling in gravity and centrifugal field. Theory of filtration, filters. Theory and practice of heat transfer. Heat exchangers and evaporators. Heat and mass transfer in drying processes. Drying rate and time. Belt, kiln and spray driers. Theory of absorption, method of transfer unit. Packed and tray columns. Separation of vapour-liquid mixtures by distillation. (5 hours/5 credits)

Introduction to the Finite Element Method

BMEGEMMAG05

József Új Ph.D.

Short history of the method. Importance in the engineering design. Mathematical, computational and mechanical background. Overview on the frequently used types of elements in the structural analysis. Detailed description of elements for truss structures and for frames. TRUSS2D, BEAM1D, BEAM2D elements. Derivation of element and structural matrices. FE modelling of skeletal structures. Symmetric structures. Closed frames. Frequency analysis of elastic frames. Critical angular velocities of rotating shafts with disks. Modelling examples. Case studies. Commercial FE softwares. Additional capabilities of FEM. (3 hours/3 credits)

Production Engineering

Dr. Ferenc Boór, Dr. Gusztáv Arz

The principles of group technology. Economical aspects of production, optimizing of the cutting process. Fundamentals of computer aided process and production planning and manufacturing. Introduction to assembly technology. Quality control and process supervision. (3 hours/4 credits)

Air-conditioning and Refrigeration I

Dr. Lajos Láng, Dr. Antal Penninger

Aim and Application of refrigeration. Cooling load. Principles. Methods of refrigeration: compression and absorption systems. Refrigerants: standpoint of selection. Vapour compression system: standard and actual vapour compression cycles, subcooling, temperature limitations, designing, components. Performance characteristics of individual componenets. Practical heat transfer calculations for buildings. Function of air conditioning, Composition of open air. Meteorology. Thermo-metry. Human thermal comfort, energy balance, comfort theory, application. Psychrometry, properties of moist air, psycrometic charts. (4 hours/4 credits)

Hydrodynamic Systems

BMEGEVGAG07

Dr. László Kullmann

Operation of pumps and fans in systems Selection of the proper machine considering safety, cavitation free operation and controllabiliti. Stability of operation of fans and compressors in systems containing large air volumes - an investigation based on a simple linear theory of stability. Computation of the flow rate and pressure distribution in looped pipe networks. Flow in open channels. Laboratory practice int he departments' PC pool. Optimisation of the operation of water distributing systems containing pumps and reservoirs for minimum electricity cost. (3 hours/3 credits)

Energy Processes and Equipments

BMEGEENAG71

Dr. Antal Penninger

Energy demands and sources. Basic processes of energy conversion: fossil, renewable, and nuclear sources. Steam- and gasturbine, IC engines, fuel-cells, solar collectors, heat exchangers, storage tanks. power stations: gas, steam and nuclear. Combined heat and Power generation. Decentralized power generation. Complex energy utilization systems. Energysave consumer equipments. (5 hours/5 credits)

Volumetric Pumps and Compressors

BMEGEVGAG04

Dr. Sándor Váradi

Positive displacement pumps. Pump characteristic and performance. Reciprocating and rotary types. Gear pumps. Performance of a gear pump. Characheristics. Pressure balancing. Bearing forces. Screw pumps. Screw pumps for delivery of higher viscosities fluid. Roots blower. Delivery, isentropic and adiabatic power. Reciprocating compressors. Compression efficiency. Valves. Regulation. Pressure-volume diagrams for different methods of regulating and governing compressors. Sliding vanes pump. Characteristic performance. Capacity and efficiency. Effect of viscosity. (2 hours/2 credits)

Measurement Techniques for Chemical and Environmental Processes

BMEGEVÉAG04

Dr. Károly Molnár

Introduction to instrumentation and measurement systems. Process instrumentation, measurement methods, instruments and techniques of various physical quantities. Online measurement with modular multi-parameter measuring system. Laboratory exercises for monitoring of waste water and air pollutantas. Receive practical hands on experinece in the laboratory using dryer, filter and heater equipment. (3 hours/3 credits)

Airconditioning and Refrigeration II

Dr. László Garbai

Performance characteristics of complete refrigeration system. Operation, capacity control, safety. Absorption system, principle of operation, relation to vapour compression cycle. Elements and processes of air handling systems. Filtration of air, filters. Treatments of air, equipmnet of heating, cooling and humidi-fication. Calculation of supply air for ventilated room, pollution and energy balance. Layout of air conditioning systems. Air movement in rooms. Hydraulic sizing of air duct system. (4 hours/4 credits)

Description of M.Sc. Subjects

Branch of Air-conditioning and Refrigeration

Advanced Mathematics

BMETKGEM101

Dr. Katalin Balla, Dr. Péter Moson

Error types. Number representation in computers. Rounding. Solution of systems of linear algebraic equations. Nonlinear equations. Interpolation and approximation of functions. Numerical integration. Ordinary differential equations. (5 credits)

Advanced Applied Mechanics

BMETKGEM102

Dr. Gábor Stépán, Dr. József Új

Fundamental concepts of elasticity. Equations of compatibility. Principle of virtual work. Fundamental concepts of the plasticity criterion of yielding. Basic ideas of model analysis and non-linear oscillations. Reduction of vibrations. (6 credits)

Computer-Aided Design

BMETKGEM103

Dr. Károly Váradi

Main fields of application for CAD. CAD hardware resources and system configurations. Functional components of CAD systems. Method bases and program libraries in CAD. Technological planning by CAD. (5 credits)

Environmental Protection

BMETKGEM104

Dr. Tibor Szentmártony, Dr. Mária Örvös

Characteristics of sound levels. Propagation of outdoor barriers. Sound adsorption and propagation in closed spaces and through walls. Enclosures. Acoustic source processes and Lighthill's theory. Noise of fluid machinery; damping methods. Solid borne noise and radiation. Techniques for measuring noise. Burning, chain reactions, and interme- diary products. Transformation of NOx; biological and corrosion effects. Smoke and dispersion calculations. Filtration, absorption, and adsorption. Waste treatment. (3 credits)

Production Engineering and Metrology

BMETKGEM105

Dr. Gusztáv Arz

Turning, boring, milling, and grinding opera- tions. Gear manufacturing. Industrial robots and their application in production engineering. Typical failures in the manufacturing processes. Nonconventional manufacturing processes. Quality assurance and control. Statistical methods in metrology. (5 credits)

Reliability of Industrial Systems

BMETKGEM106

Dr. Tibor Balázs

Equipment and elements which are charac- teristics to the process industries. Life phases of equipment. Fundamentals of functional analysis. Standards and codes for pressure vessels. Probabilistic concept of reliability. Failure distributions. Reliability of standard systems. Maintenance policies. (3 credits)

Advanced Thermodynamics

BMETKGEM201

Dr. Csaba Horváth, Dr. László Rádonyi

Steady-state heat conduction. Walls and cylinders with heat sources. Unsteady heat conduction; conduction in a semi-infinite slab. Heat conduction with moving boundaries. Flow boiling and condensation. Direct contact condensers and flat jet condensers. Radiative heat transfer. Radiation density and pressure. Mass transfer. Parameters that describe a mixture. State equations of real gases. Real gas mixtures. Fugacity, free energy, and free enthalpy. Solidification and fusion; sublimation and desublimation. Triple-point. Entropy analysis of thermodynamic processes. Thermodynamics of inherently irreversible processes. (4 credits)

Advanced Fluid Mechanics

BMETKGEM202

Dr. Tamás Lajos

Transient flow in pipes. Characteristic methods. Method of singularities. Flows concerning exhaust systems. Vorticity-transport equations and their applications to viscous two-dimensional flows at constant viscosity. Numerical treatment of rotationally symmetric flows at constant viscosity by finite differences. Boundary layer equation and its range of validity. Generalization of the constitutional equation for metals in the plastic state. (4 credits)

Mass Transfer

BMETKGEM203

Dr. László Tömösy

Phenomenological theory of molecular diffusion. Diffusion in liquids and solids. Transient diffusion in stagnant media. Turbulent diffusion. Mass transfer at a phase boundary. Analogies between mass, heat, and momentum transfer. Simultaneous momentum, heat, and mass transfer. Continuous-contact packed-column design. Design procedures. (5 credits)

Building Physics

BMETKGEM204

Dr. András Zöld, Dr. János Várfalvi

Microclimate, meteorological environment. Unsteady energy balance of building envelope structures. Energy balance of rooms. Calculation of summer thermal load. Methods for measuring energy balance in buildings. Humidity and vapour wandering in buildings. Airflow in buildings. Fundamentals of indoor lighting and building acoustics. Sound control in buildings. (4 credits)

Refrigeration and Heat Pump

BMETKGEM205

Dr. Lajos Láng, Dr. Antal Penninger

Industrial, agricultural, and other applications of refrigeration via the heat pump. Cooling and heating load. Refrigeration and heat pump circuits and systems. Absorption systems. Heat exchange between strong and weak solutions, and rectifications. Two-stage absorption system. Condensers, air-cooled or water-cooled evaporative converters. Absorber, boiler stripping column, and rectifier. Heat pumps, heat sources, users, and conditions of economic adaptation. (6 credits)

Ventilating and Air-conditioning I-II

BMETKGEM206 BMETKGEM301

Dr. László Bánhidi, Dr. László Garbai

Physiological principles of human comfort. Basic equations of simultaneous heat and mass transfer. Calculation of heat and humidity load. Permanent, intermittant, and natural ventilation. Pressure and air movement in rooms. Air-conditioning systems. h-x and t-x charts. Materials for air ducts. Duct sizing; friction and dynamic losses. Duct design methods; optimum design; economic analysis. Coil construction and materials. Steam and water coils. Air washers and evaporative air coolers. Air filtration equipment. Atmospheric and industrial filters. Nonconventional air conditioning systems. (4+5 credits)

Public Utilities

BMETKGEM302

Dr. Lajos Barna

Pipeline layout and corrosion protection. Water supply. Quality requirements for drinking water. Methods of obtaining water and means of water purification. Hydraulic dimensioning. Drains. Sewages. Calculation of sewage rate. Hydraulic sizing. Gas supply. Standard gas quantity requirement. District heating. Electricity supply. Electrical network, lighting, and equipment. (3 credits)

Control Systems

BMETKGEM303

Dr. Zoltán Molnár, Dr. László Garbai

Types of controllers. Modes of control action; periodic and continuous operation. Sensors and instrumentation. Temperature, humidity, and pressure sensing. Control devices. Air-flow dampers. Valves. Construction terms and constructions. Actuators. Control of heating systems. Water and steam media. Control of ventilating and air conditioning systems. Elementary control systems. (4 credits)

Laboratory

BMETKGEM304

Dr. Lajos Barna

Dry and wet bulb temperatures, humidity, air velocity, surface temperature, and human comfort in a room. Air contaminants and dust composition. Characteristic air states in air handling apparatus. Air velocity and pressure drop in air ducts. Pressure drop because of airflow dampers and air filters. Regulating valve characteristics. Heat performance and transient condition for heating coil. Performance and regulation of refrigeration plants. Operation and control of the heat pump. (4 credits)

Heat Supply Systems

BMETKGEM305

Dr. Zoltán Molnár, Dr. László Garbai

Heat requirements for a room; unsteady and steady-state heat balance. Heat transmission, infiltration. Heat production and possibilities. Heat supply systems. Equipment. Boilers. Fuel supply and burners. Chimney. Heat exchangers. Heaters. Layout of central systems. Water medium; forced circulation systems. Steam medium; low-pressure systems. Methods for hydraulic pipe sizing. (3 credits)

Modelling and Simulation

BMETKGEM306

Dr. György Lipovszki

Mathematical models of physical systems. Differential equations of physical systems; transfer functions, block diagrams, and signal flow graphs. Electric, hydraulic, and pneumatic systems. Compensation techniques. Analysis and design of variable states. Common physical nonlinearities. Testing of energetic systems by simulation. (5 credits)

Branch of Production Engineering

Advanced Mathematics

BMETKGEM101

Dr. Katalin Balla, Dr. Péter Moson

Error types. Number representation in computers. Rounding. Solution of systems of linear algebraic equations. Nonlinear equations. Interpolation and approximation of functions. Numerical integration. Ordinary differential equations. (5 credits)

Advanced Applied Mechanics

BMETKGEM102

Dr. Gábor Stépán, Dr. József Új

Fundamental concepts of elasticity. Equations of compatibility. Principle of virtual work. Fundamental concepts of the plasticity criterion of yielding. Basic ideas of model analysis and non-linear oscillations. Reduction of vibrations. (6 credits)

Computer-Aided Design

BMETKGEM103

Dr. Károly Váradi

Main fields of application for CAD. CAD hardware resources and system configurations. Functional components of CAD systems. Method bases and program libraries in CAD. Technological planning by CAD. (5 credits)

Environmental Protection

BMETKGEM104

Dr. Tibor Szentmártony, Dr. Mária Örvös

Characteristics of sound levels. Propagation of outdoor barriers. Sound adsorption and propagation in closed spaces and through walls. Enclosures. Acoustic source processes and Lighthill's theory. Noise of fluid machinery. Damping methods. Solid borne noise and radiation. Techniques for measuring noise. Burning, chain reactions, and intermediary products. Transformation of NOx; biological and corrosion effects. Smoke and dispersion calculations. Filtration, absorption, and adsorption. Waste treatment. (3 credits)

Production Engineering and Metrology

BMETKGEM105

Dr. Gusztáv Arz

Turning, boring, milling, and grinding operations. Gear manufacturing. Industrial robots and their application in production engineering. Typical failures in the manufacturing processes. Nonconventional manufacturing processes. Quality assurance and control. Statistical methods in metrology. (5 credits)

Reliability of Industrial Systems

BMETKGEM106

Dr. Tibor Balázs

Equipment and elements which are character- istic to the process industries. Life phases of equipment. Fundamentals of functional analysis. Standards and codes for pressure vessels. Probabilistic concept of reliability. Failure distributions. Reliability of standard systems. Maintenance policies. (3 credits)

Manufacturing Process Planning

BMETKGEM207

Dr. Ferenc Boór, Dr. Gusztáv Arz

Levels of planning in the manufacturing process. Bases; positioning. Sources and types of production errors. Special production processes; surface coating, EDM (electric discharge machining), and lasers. Assembly automation. Programming languages. Information requirements for process planning; data bases. Preplanning process and operational sequences. Postprocessing. Diagnostics; supervision and quality control. Structure and characteristic features of computer-aided process planning systems. (4 credits)

Advanced Material Sciences

BMETKGEM208

Dr. András Reé, Dr. János Ginsztler

Interaction between atoms and types of atomic bonds. Types and characteristics of the crystalline state. Thermodynamics of alloys. Lattice vibrations, specific heat, and thermal conductivity. Possibilities of increasing the strength of materials. Basics of heat treating. (5 credits)

Machine Tools and Industrial Robots

BMETKGEM209

Dr. Gusztáv Arz

Fundamentals of the kinematics of metalcutting machine tools and industrial robots. Lathes. Boring and milling machines. Industrial robot- arm configurations. Kinematics for robot joints, links, and the gripper. The industrial robot-machine tool connection. Grinders; gear hobber and shaper. (5 credits)

Advanced Metal Forming

BMETKGEM210

Dr. András Reé, Dr. János Ginsztler

Calculation method based on energy and typical applications. Design and evaluation of slip-line fields. Visioplasticity methods. Formability and workability. Planning a bulk-forming process. General properties of sheet metals. Universal piercing tool systems. Bending. Deep drawing. (5 credits)

Fatigue and Fracture of Structural Materials

BMETKGEM211

Dr. Jeno Lovas, Dr. János Ginsztler

Possible level of studying fracture processes: macro, micro and atomistic. Fracture criteria. Role and importance of the plastic zone. Concept of COD (crack opening displacement), J-integral, and equivalent energy. Phenomenon of fatigue. Critical analysis of traditional tests and their results. Fatigue crack propagation. Problems of short cracks. Thermal fatigue. Thermal cycles during welding and structural changes. Hot cracking. Heat treatment of welded joints and structures. Fatigue testing. Creep. Survey of nondestructive testing methods. Radiology and radioisotope testing techniques. Testing with magnetic particles and penetration methods. Evaluation of non- destructive testing results. (3 credits)

Computer-Aided Quality Assurance

BMETKGEM212

Dr. Tibor Szalay, Dr. Gusztáv Arz

Aims of computer-aided quality assurance (CAQA). Fundamentals of measuring theory. Statistical methods for the analysis of measured data. Computer applications. Fundamentals of computer-aided quality control in manufacturing systems. Manually operated and CNC-controlled multi-coordinate measuring machines. Laser interferometers. (5 credits)

Computer-Aided Production Engineering

BMETKGEM308

Dr. Ferenc Boór, Dr. Gusztáv Arz

From manufacturing process planning to computer-aided production engineering. Planning the manufacturing process. Design of manufacturing processes. Modelling and simulation of objects, systems, processes, and equipment. Supervision of diagnostics and quality control. Forms of production organization. Cost-planning and analysis. Group technology. (5 credits)

Advanced Welding Technology

BMETKGEM309

Dr. Béla Palotás

Oxyfuel gas welding. Manual arc welding with covered electrodes. Gas tungsten arc welding. Gas metal arc spot welding, narrow gap welding, and pulsed arc welding. Submerged arc welding. High energy-density beam welding. Thermal cutting methods. (4 credits)

Weldability and Testing of Welded Construction

BMETKGEM310

Dr. Béla Palotás

Thermal cycles during welding and structural changes. Hot cracking, cold cracking, and lameral tearing. Heat treatment of welded joints and structures. Static and dynamic testing methods. Evaluation of mechanical testing results. Automatic nondestructive testing systems. (3 credits)

Computer-Integrated Manufacturing

BMETKGEM311

Dr. János Somló

Introduction to the concept of computer- integrated manufacturing (CIM). Interconnec- tions of functional modules. Different levels of system build-up. Methodology of system design; software tools (simulation programs). Manufacturing systems. General rules for interfaces. Global design rules for data, data processing, and data communication. (5 credits)

Tool and Die Design

BMETKGEM312

Dr. András Reé, Dr. János Ginsztler

Tool and die functions in manufacturing. Solid modelling methods and database management. Classification of tools. Features of single-point cutting tools and single-point rotary cutters. Strength analyses and the supervision of tools. Specific problems of metal-forming dies. Elements of die sets. (4 credits)

Forming and Forging Machines

BMETKGEM313

Dr. András Reé, Dr. János Ginsztler

Machines based on kinetic energy, such as hammers and friction presses. Electrodynamic forming machines and pneumo-mechanical forming machines. Machines with special kinematics. Elements of robotizing presses and press lines. (3 credits)

Integrated Engineering

Mechanical Drives

BMETKGEM107

Dr. István Elinger, Dr. Sándor Bisztray

Task and types of drive systems: mechanical, hydraulic, pneumatic, electric drive systems. The main characteristics of drive systems Special mechanical drives: planetary gears, harmonic gears, cycloid gears. Selection and dimensioning on strength. Hydraulic and pneumatic drives. Hydrodynamic and hydrostatic drive systems. Typical applications, advantages, disadvantages. Operational cycles and elements (pumps, hydro motors, controlling elements, reservoirs etc.). Electric drives: DC and AC motors, selection and control. Dynamic properties of drive systems. Problems of modelling. Avoiding of vibrations and controlling of the system. (4 credits)

Materials Engineering

BMETKGEM213

Dr. J. Lovas, Dr. A. Reé, Dr. B. Palotás, Dr. I.Mészáros

Types and selection of materials for machine structures (metals, alloys, ceramics and polymers). Interactions between the material, construction and technology. Steels and light metals with increased flow stress. Metallic materials with special properties. Technical ceramics, production, properties and applications. Polymer materials, melt properties, special processing and applications. Composite materials, base and strengthening materials. Production and application of metal, ceramic and polymer base composites. Short projects for materials selection and engineering. (5 credits)

Dynamics of Machines

BMETKGEM214

Dr. Gábor Stépán

Review of rigid body dynamics and vibrations. Time domain and frequency domain analysis. Basic concept of modal testing. The frequency response function of linear mechanical systems. Parameter identification: classical methods (half-power, logarithmic decrement), fast Fourier transformation based methods. The experimental tools of modal testing (exciters and detectors). The basic concept of vibration monitoring of machines. (3 credits)

Advanced Flow Measurements

BMETKGEM215

Dr. Gábor Halász

Flow characteristics, quantities, measurement principles. Measuring methods: constant temperature hot wire anemometry, Laser Doppler anemometry, Particle image velocimetry, optical concentration measurements of changing pressures. Equipment, data acquisition and processing. (3 credits)

CIM Technology

BMETKGEM314

Dr. János Somló

Hardware and software tools of CIM. Functional modules and sub systems. Flexible manufacturing cells and systems. Control architecture. Diagnostics, supervision, monitoring, optimisation and adaptive control. Computer Aided Process Planning, Manufacture Resource Planning, Production Planning and Scheduling. Computer Aided Quality Assurance, Storage and Transportation. Management Information System. Pilot CIM system of BME. (4 credits)

CAD Technology

BMETKGEM315

Dr. Gábor Renner

Main fields of application for CAD (Computer Aided Design) in mechanical engineering. CAD hardware resources and system configurations. Functional components of CAD systems. Objects and databases. Method bases and program libraries in CAD. Output processing and documentation. Technological planning by CAD. The subject includes a project. (5 credits)

Near Net Shaping

BMETKGEM316

Dr. György Ziaja

Determination of NNS manufacturing. General aspects and relationships between design, materials and processes. Precision castings, powder metallurgy, cold, warm and ferritic forging. High precision hot forming processes: high energy rate, isothermal and superplastic forming. Fine blanking. Increasing of the fittability of sheet metal formed parts. General rules of die design for high precision manufacturing. (5 credits)

Information Management

BMETKGEM317

Dr. Péter Tamás

Information system of an enterprise. Management aspects of the globalisation: outsourcing, virtual enterprise. Hardware environment: Client/Server Systems. Mainframe vs. network. Problems of information processing in a virtual enterprise. Software environment: Internet, INTRANET and the workflow management. Some examples for the workflow management: task sharing, software support, management and organisation aspects. From the requirements to the software maintenance (basic of software engineering): requirement analysis, structured information flow analysis, object-oriented analysis and data modelling. software design (data design, design of the architecture and procedures), content of the design documentation, design of the data flow and the user interfaces. Quality assurance in software engineering. Information system's updating and maintenance. (3 credits)

Structural Analysis

BMETKGEM318

Dr. Károly Váradi, Gábor Körtélyesi

Numerical methods in CAD. Computer simulation. Structural analysis and design. The finite element method. Element types. FE systems. Modelling (FE mesh, material properties, boundary conditions, loading). Engineering structural analysis (static, dynamic and thermal problems). Case studies. Design optimisation. Size and shape optimisations. Integrated CAE systems. (3 credits)

Analog Informatics I

BMETKGEM108

Sándor Keresztély, Dr. István Nagy

The role of analogue electronics in complex systems: filtering, amplifying, transforming signals. Actuators. Examples: radio & TV, car electronics. Semiconductors: basic principles, diodes, transistors. Special devices. Varicap. Integrated circuits. Characteristics and applications. (3 credits)

Analog Informatics II

BMETKGEM216

Sándor Keresztély, Dr. István Nagy

Amplifiers: single and multistage transistor amplifiers, analysis and design. Feedback: gain and impedances. Application of operational amplifiers. Power amplifiers. Analogue transducer, PID controller. Filters. The analogue switch. Sample & hold, A/D and D/A converter, analogue multiplexer, demultiplexer. Simulation of analogue circuits. (2 credits)

Digital Informatics I

BMETKGEM109

Dr. György Glöckner, Dr. István Nagy

Number systems, Boolean algebra. Logic design of combinational networks. Hazards in combinational circuits. PLA, PAL, gate array and ROM realisations. Components of digital systems: shift registers, counters, open collector and tristate bus drivers, flipflops, MSI circuits. (3 credits)

Digital Informatics II

BMETKGEM217

Dr. György Glöckner, Dr. István Nagy

Asynchronous sequential networks. State reduction and assignment. Race problems and hazards. Types, architecture and operation of microprocessors. Instruction Set. Memories. Peripherals. Interfaces. Assemblers. Applications of microcomputers. Laboratory activities: complex problem solving. (3 credits)

Power Electronics and Motion Control I

BMETKGEM112

Dr. István Nagy, Dr. Rafael K. Járdán

Components. Rectification, one and multiphase circuits, various loads, single and bi-directional power flow. Network pollution. DC/DC conversion, choppers, resonant, quasi-resonant circuits. Single and three phase AC\AC conversion, cycloconverters. (3 credits)

Power Electronics and Motion Control II

BMETKGEM218

Dr. István Nagy, Dr. Rafael K. Járdán

DC\AC conversion, current and voltage source inverter configurations, PWM modulations. Computer control, modelling and simulation. Applications. Kinetics and properties of electric drives. DC machine dynamics. One and four quadrant drives. Brushless d.c. motors. Space vector concept. Inverter-fed variable frequency AC drives. Principle of field-oriented control, vector control for induction and synchronous machines. Servo-mechanisms. Speed and position feedback systems. Applications. (6 credits)

Integrated Measurements

BMETKGEM319

Dr. Károly Fock

Basics of electric measurements techniques. Conversion of physical and chemical quantities to electric signals. Transmission and conversion of analogue and digital electric quantities. Computerised data acquisition and processing. Applications: Measurement of mechanical, optical quantities, time, heat, chemical concentration. Aspects of Quality Assurance. Accuracy and calibration of instruments. (5 credits)

Microelectronics and Microsystems

BMETKGEM320

Dr. Imre Zólomy, Dr. János Mizsei

Bipolar and MOS technologies. Realisations (gates, flip-flops, registers, counters, multiplexers, combinational multiplier, microprocessor, etc.). Operational amplifier. A/D, D/A converters. Semiconductor memories. Automatic VLSI circuit design systems. ASIC circuits. Programmable logic devices (PLDs). Thin and thick film technologies. Hybrid, surface-mounted and traditional printed circuit boards. Mounting, interconnection and encapsulating. Computer-aided design of circuit modules. Mechanic construction, thermal problems, noise protection. Application of semiconductor technology in micromechanics. Basic elements of micromechanics. Integrated sensors and microactuators. (5 credits)

Laboratory

BMETKGEM113

Dr. György Krállics, Károly Zabán

The subject includes integrating measurements from mechanical (2 hours/week) and electrical (4 hours/week) fields. Measurement of the mechanical characteristics of different machines (engines, fluid machines, machine tools). Investigation of two and four pole networks. Investigation of combinational and sequential networks. Measurement of electronic components. Measurement of basic amplifier circuits. Investigation of operational amplifier. Examination of the operation of a microcomputer. Investigation of A/D and D/A converters. (5 credits)

Integrating Project I

BMETKGEM219

Dr. István Nagy, Dr. Rafael K. Járdán

The subject includes individual projects, which integrates two or more engineering and/or software disciplines. The students have to summarise their project in a report to be presented with the participation of the supervisor and other students. (7 credits)

Integrating Project II

BMETKGEM321

Dr. István Nagy, Dr. Rafael K. Járdán

The subject includes integrating projects based on mechanical, electrical and economical knowledge. The projects have to be prepared by a group of students in team work. The projects contain design, manufacturing and assembly elements, as well as controlling, interfacing and software tasks. The result is an operating equipment, a report and an oral presentation. (7 credits)

Marketing

BMETKGEM110

Dr. Magdolna Egri, Dr. József Veress

The role of marketing in organisations, strategic planning and marketing planning. Marketing information systems and marketing research, segmenting and targeting markets. Developing and launching new products and services, life cycle management, pricing strategies, selecting and managing distribution systems. Marketing communication and promotion strategies, evaluating marketing performance. (4 credits)

Production Management

BMETKGEM220

Dr. Eniko Legeza

Production in management context, production requirement forecasting, production planning. inventory control, material requirement planning, material handling. Dynamic and static scheduling, shop-floor layout planning, reliability and maintenance. Project-type production, flexible manufacturing systems. Just-in-time production, organising continuous manufacturing. (4 credits)

Software Informatics

BMETKGEM322

Zoltán Süto, Dr. István Nagy

Computer architectures and CPUs. Memory organisation and management. Multi-user operating systems. Parallel processing. Bus control. Operating systems. Multi-programming, multiprocessors. Process management. Concurrent processes, synchronisation and communication. Virtual memory. File systems. Mathematical foundations. Formal languages. Finite automata. Context-free languages, language transformations. Compilers, process of compilation. Structured programming. Abstract and recursive data. Object-oriented, functional, declarative programming. Computer networks. Physical, data-link, network, transport and session levels. Databases. Introduction to SQL. (4 credits)

Human Resource Management

BMETKGEM111

Dr. Eniko Legeza

Organisational behaviour in management context, motivation, leadership, organisational design and culture, group work. Managing organisational change and development. Manpower planning, job analysis and evaluation. Appraising employee performance, recruitment, selection, compensation, legal aspects. (4 credits)

Finance

BMETKGEM221

Dr. Márta Szabó

The balance sheet, the profit statement, ratio analysis. Dividend policy and capital structure, working capital. Capital investment decisions and performance evaluation afterward, relationship between return and risk. Financial planning, budgeting, financial control, cash flow management. International financial transactions. Valuation stocks and bonds. Financing by loans, credits, leasing, methods of self-financing. (4 credits)