semester	Neptun code	Course name	credit no.	no.of classes/ week - theory	no.of classes/ week - practice	Level	Lecturer	e-mail	Institute	Short description
autumn	GEMTT002-Ma	Advanced Materials Processing	5	2	2	MSc	Dr. Marcell Gyula Gáspár	marcell.gaspar@uni-miskolc.hu	Material Science and Technology	Advanced materials processing for primary shaping. Technology of powder metallurgy, characteristic metallic, ceramic and composite products. Advanced casting processes used in machine part manufacturing. Properties and design principles of cast products. Introduction to welding theories. The most important fusion and pressure welding processes and their modern process variants. High energy densitiy welding processes. Brazing and soldering. Thermal cutting. Heat treating processes of machinery. Heat and material transport. Annealing processes. Hardening and strengthening processes. Toughening processes. Structure and properties modification in surface layers with thermal, physical and chemical methods. Advanced cold and hot metal forming for machine parts manufacturing.
autumn	GEMAN114-B2a	Analysis I.	5	2	2	BSc	Dr. Krisztián Hriczó	krisztian.hriczo@uni-miskolc.hu	Mathematics	Set theory, properties of real functions, sequences. Limit value, continuity of univariate real functions, Notable curves, Differential calculus and its applications, Mean value theorems of dif-ferential calculus (Rolle, Lagrange, Cauchy), L'Hospital rules, Function analysis. The indefinite integral, integration rules. Rational fractional functions, decomposition of rational fractional functions into partial fractions, integration of partial fractions, integration of rational fractional functions of the exponential function, cos(x), sin(x).
spring	GEMAN124-B2a	Analysis II.	5	2	2	BSc	Dr. Krisztián Hriczó	krisztian.hriczo@uni-miskolc.hu	Mathematics	The definite integral and its applications, improper integral. Bivariate functions. Double integral and its applications. Triple integral and its applications. First-order ordinary differential equa-tions, second-order differential equations with constant coefficients. Vector-scalar functions. Scalar-vector functions. Vector-vector functions.
spring	GEIAK631-Ma	Applied Machine Learning	4	2	2	MSc	Dr. Samad Dadvandipour	samad.dadvandipour@uni-miskolc.hu	Information Science	The aim of the course is to acquaint students with the essence of the applied machine learning algorithms and one of their representatives, the possibilities of the Microsoft Azure studio. Provide insight into specific areas of applied Artificial Intelligence. It gives an overview of robots and then details the structure, operation and motion control of humanoid robots. Demonstrates particle swarm-based optimization. Describes behavioral robotics, visual systems and speech recognition technologies and learning algorithms of humanoid robots. Provides an overview of brain-machine interfaces. It analyzes the expansion of brain capabilities and the ethical issues of machine intelligence in terms of human competitiveness.
autumn	GEVAU218-Ma	Architectures and Embedded Systems	5	2	2	MSc	Dr. József Vásárhelyi	jozsef.vasarhelyi@uni-miskolc.hu	Automation and Communication Techn	Embedded system components and structure. Input output elements of and embedded system. Signal conditioning, signal processing; Micro-controllers, microprocessors FPGA architecture, Digital signal processors; processing elements and optimal solution for system integration. Embedded system communication (wired and wireless); Hardware – software co-design, hardware in the loop simulation/testing. Embedded system design process from hardware to software development; Operating systems for embedded system applications; Model based development. Debugging embedded systems. Re-configurable and adaptable architectures. Open standard processor architecture: ARM
autumn	GESGT001-Ma	Automated Machine Tools	5	2	2	MSc	Dr. György Hegedűs	gyorgy.hegedus@uni-miskolc.hu	Machine Tools and Mechatronics	Definition of automation. Discrete and continuous systems, methods for describing and handling them. Basic types of controllers. Principle of Numerical Control (NC). History of NC. NC generations. Functions of NC controllers. Controlled machine functions. Geometry of NC machine tools. Coordinate systems: machine CS, programmer's CS, tool CS. Programming methods. Structure of NC programs. Codes, programming tips. WOP in CNCs. Manufacturing cells, manufacturing systems as higher level of automation in machinery. Simulation of discreet systems (e.g. manufacturing cells): event-based simulation. Theory of interpolation. Interpolation methods. 2-3-5D interpolation.
autumn	GEGTT500-B2a	Basics of Manufacturing Technology	5	2	2	BSc	Dr. Zsolt Maros	zsolt.maros@uni-miskolc.hu	Production Engineering	Main scientific fields, basic terms structure and systems approach characteristics of manufacturing technology.
spring	GEALT505-B2a	Basics of Process Development	5	2	2	BSc	Dr. Péter Tamás	peter.tamas@uni-miskolc.hu	Logistics	The history of the development of Lean. 5 principles. Methods to define value-creating, non-value-creating processes, and losses (MURI, MUDA, MURA). Steps to draw a value stream map. Preparation of a present and future state map. Introduction to Lean tools (5S, Andon system, visual management principles, Poka Yoke, SMED, Pull principle, JIT, Kanban, Jidoka, Heijunka, Kaizen, etc.). Application of Lean tools in practice.

autumn	GEAGT107-B2a	Basics of Technical Description	4	2	2	BSc	Szilvásiné Dr. Erika Rozgo	erika.szilvasine.rozgonyi@uni-miskolc.hu	Mathematics	Sketching in axonometry. Constructions in the representation of Monge, mapping of points, lines and planes, intersection problems. Introducing new image planes. Representation of circles. Representation of polyhedra and surfaces of revolution, and their intersection with plane. Preparations of technical drawings and documentations. Standards, drawing types, lines and captions, Views, section views, profiles for mechanical drawings. Special representation methods. Dimensioning, building of dimensions, special dimensions. Representation of threaded parts. The ISO tolerance system. Geometric and position tolerance, surface finishing. Connecting parts, ISO system of fits. The basics of Computer Aided Design (CAD), rapid prototyping.
spring	GEIAL33H-B2a	Basics of Web Technologies	3	1	2	BSc	Dr. Anita Agárdi	anita.agardi@uni-miskolc.hu	Information Science	Overview of HTTP standard (HTTP protocol, Request/Response model,HTTP methods), Presentation of the Network basics (Client-server architecture; IP addresses and DNS), Learning the HTML basics (Structure of an HTML document, list, table, image, link, forms), CSS basics (Syntax and usage of CSS, Inline, internal, and external styles, Colors, fonts, spacing, borders, and box model, CSS selectors), Usage of Javascript (Variables, data types, operators, control structures, functions and events, form validation), Jquery language (DOM traversal and manipulation, event handling), JSON data structure (structure and syntax of JSON, converting between JSON and JavaScript objects).
both	GESGT001B-a	CAD design and Simulation of Machine To	4	2	2	BSc	Dr. György Hegedűs, Kiss D	hegedus.gyorgy@uni-miskolc.hu, kiss.danie	Machine Tools and Mechatronics	Introduction to elements of machine tools (bearings spindles slides etc.). CAD modelling techniques of above mentioned elements. FEM modelling of complex assemblies (drives spindles lathes). FEM analysis of assembly modells including vibrational structural and thermal influences.
both	GEGET702-Ba	CAD systems	3	1	2	BSc	Dr. Bihari Zoltán	zoltan.bihari@uni-miskolc.hu	Machine and Product Design	Demonstrate the basic functionality of the Solid Edge 3D parametric design system while modelling different machine components. Simple shapes in the Part module. Creating a part drawing in the Draft module. Making assemblies in the Assembly module. Creating an exploded view. Design of different fasteners, design of toothed machine elements, design of bearing arrangements.
spring	GEVGT001-B2a	Chemical Technologies and Equipment	4	2	2	BSc	Dr. Zoltán Szamosi	zoltan.szamosi@uni-miskolc.hu	Energy Engineering and Chemical Mach	World history of the chemical industry, Hungarian and regional conditions. Basic operational concepts, physical quantities and equations describing units in unit operation, classifying of op-erations. Sedimentation, filtration, dust and drop separation and their equipment. Centrifuga-tion, mixing, size reduction and their equipment. Theoretical foundations of heat transfer, heat exchange. Heat transfer calculation and equipment. Theoretical foundations of mass transfer, distillation. Rectification, batch distillation, structural designs. Basic concepts of pressure vessel design, sizing foundations. Risks, hazardous materials. The overpressure protection, designation of designing guidelines, subsystems. Overpressure protection devices. Safety valves and rupture discs and panels.
spring	GEMAN003B-a	Complex functions	3	2	0	BSc	Dr. Krisztián Hriczó	krisztian.hriczo@uni-miskolc.hu	Mathematics	Complex algebra. Complex function. Elementary complex functions Riemann surfaces. Limits and continuity of complex integration and Cauchys theorem. Cauchys integral formula. Laurents series. The residue theorem. The unilateral Laplace-transforms and its properties. Evaluations of inverse transforms. Applications.
spring	GEMTT114-Ma	Computer Aided Process Planning	4	2	2	MSc	Dr. Zsolt Lukács	zsolt.lukacs@uni-miskolc.hu	Material Science and Technology	Computer Aided Engineering methods in forming processes. Analysis of the technological processes from the point of view of Computer Aided Process Planning. The various methods of Computer Aided Process Planning: the variant and the generative approach. Application of knowledge based systems in the process planning of forming processes. Technological databases: development, structure and handling of technological databases. The balance of interactivity and programmed process planning (batch processing) in manufacturing processes. The documentation requirements. Connection between CAD, CAPP and CAM systems. Application of commercial CAD systems to support the tool design. The concept of Computer Integrated Manufacturing.

autumn	GEIAL301-B2a	Computer Architectures	5	2	2	BSc	Dr. Szilveszter Kovács	szilveszter.kovacs@uni-miskolc.hu	Information Science	Basic computational models. Computer architecture concept. Neumann architecture: processor, memory, I/O devices, system bus. The general microprocessor architecture. Structure of processors, instruction set architecture. Processor performance measures and enhancement. CISC and RISC concept. Internal parallelization. State-of-the-art processors. The storage, semiconductor storage, their classification, operation and performance enhancement. Trends in the development of semiconductor storage devices. Buses, their classification and performance enhancement. Bus standards. I/O devices, their classification and the role of I/O control circuits. The construction of the common devices (magnetic and optical disks, displays, keyboards, pointing devices, printers), their operating principles, and performance enhancement. Command language user interfaces. Shell programming. Graphical user interfaces.
autumn	GEIAL304-B2a	Computer Networks	5	2	2	BSc	Dr. Szilveszter Kovács	szilveszter.kovacs@uni-miskolc.hu	Information Science	Layered network architectures, physical layer, media access control sub-layer, channel sharing methods, common media access control standards (IEEE 802.3, 802.11), the data link layer, frame formation procedures, basic knowledge related to error protection, the network layer functions and services, traffic control methods, congestion control, inter-network cooperation, common network architectures (IPv4, IPv6), the Internet and its services.
autumn	GEIAK201-B2a	Computer Studies	4	2	2	BSc	Dr. Károly Nehéz	karoly.nehez@uni-miskolc.hu	Information Science	Familiarization with the structure and operation of the Computers, building user competencies for the advanced use of MS Office applications, providing knowledge on the topic of viruses, devel-oping intermediate C language programming skills.
autumn	GEIAL31S-B2a	Computer Studies	4	2	2	BSc	Dr. György Wagner	gyorgy.wagner@uni-miskolc.hu	Information Science	Building on the office applications of Ms Office 365, getting to know and practicing the basic functions that can be used during the basic logistics training. To prepare the students to be able to use electronic correspondence, text editing and spreadsheets, to process data and data series with the help of the built-in and self-created functions during their training and after graduation.
autumn	GEMET206M-a	Continuum Mechanics	3	3	0	MSc	Prof. Dr. György Szeidl	gyorgy.szeidl@uni-miskolc.hu	Mechanics	A short introduction to tensors. Kinematics of continua. State of velocity. Nonlinear theory of deformations (deformation gradients, strain tensors). State of velocity. (Velocity gradient, rate of deformation tensor, vorticity tensor, vorticity vector). Variation of tensor fields with time (material time derivatives, objective time derivatives). Linear theory of deformations. Fundamental laws of continuum mechanics in spatial and material descriptions. Stress tensors (Cauchy, Piola Kirchoff I. and II.). Equation of continuity. Equations of motion. Moment of momentum. The fundamental principles of thermodynamics. Special vector fields in continuum mechanics (various admissible tensor fields). Principle of virtual power. Principle of virtual work. Constitutive equations: (thermo)elastic viscoelastic and elastic-plastic bodies. Fundamentals of linear elasticity: Energy theorem. Navier equation. Principles of minimum potential energy. The dual system of elasticity. Equations of compatibility. Castigliano's principle. Variational principles (the whole system of these principles). Book recommended: György Szeidl: Continuum mechanics. Lecture notes. 2016. Provided free to the students in pdf format.
spring	GEVAU193-B2a	Control Engineering	5	2	2	BSc	Dr. Attila Trohák	attila.trohak@uni-miskolc.hu	Automation and Communication Techn	We learn about the structure, operation, and programming of PLC-based control systems. We deal with the basics of operation of sensors and actuators and their installation. We learn about structure, operation, and configuration of human-machine interfaces.
autumn	GEIAL526V-Ma	Data Analysis and Data Mining	5	2	2	MSc	Prof. Dr. László Kovács	laszlo.kovacs@uni-miskolc.hu	Information Science	Overview of data analysis tools and levels, basic statistical tools, Bayesian network, comparison of OLAP and OTLP; decision support tools, MD data model, semantic MD models, MD algebra, Oracle PE OLAP commands, programming MD databases in PE, Overview of MDX language; basic MDX queries, derived sets and measures; ETL processes, Overview of data mining, Data clustering methods, SOM, data classification methods, BPNN, SVM, mining association rules, detection of outliers, dimension reduction methods, PCA.
spring	GEMAK121-B2a	Data Structures and Algorithms	5	2	2	BSc	Dr. Attila Házy	attila.hazy@uni-miskolc.hu	Mathematics	The representation of real numbers. Algorithms of number theory (greatest common divisor, Euclidean algorithm, Fermat-test), RSA. Algorithms: Definition, Properties, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notations (Order of growth, the master theorem (method)) Data structures: Introduction, Data Structures types, arrays, linked lists (singly linked lists, circular linked lists, doubly linked lists,..) stack and queue. Sorting (Introduction, Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Heap Sort) and searching: (Introduction, Linear search, Binary search, Fibonacci search). Trees (Introduction, definition and basic terminologies, representation of trees), binary Trees (basic terminologies and types, binary search trees….) and graphs.

autumn	GEIAL322-B2a	Database Systems I.	5	2	2	BSc	Dr. László Kovács	laszlo.kovacs@uni-miskolc.hu	Information Science	Overview of persistency methods; Foundation of database systems; DBMS and DB; Semantic modelling, ER model; Relational structure and integrity rules; Convertion of ER into relational model; overview SQL; SQL DDL commands; SQL DML commands; Relational algebra; Query expressions in SQL; Conversion relational algebra into SQL; Relational database objects; Indexes and VIEW elements; normalization of relational schema. Security layer in DBMS; Basic operations in SQLite. SQL API foundations for JDBC.
spring	GEIAL323-B2a	Database Systems II.	5	2	2	BSc	Dr. László Kovács	laszlo.kovacs@uni-miskolc.hu	Information Science	Overview SQL API architectures (ODBC, JDBC, JPA) , JDBC class hierarchy; JDBC classes and methods; cursor handling in JDBC; metadata in JDBC; stored procedure in Oracle, overview of PL/SQL language; SQL operations in PL/SQL, cursor management in PL/SQL, usage of PL/SQL packages; Transaction management architecture, history types in DBMS; locking protocol; operation of the locking module; query optimization module in DBMS, algebraic execution graph, otimization steps; query execution plan.
autumn	GEAGT101-B2a	Descriptive Geometry	4	2	2	BSc	Óváriné Dr. Zsuzsanna Bal	zsuzsanna.ovarine.balajti@uni-miskolc.hu	Mathematics	Representation of Monge: mapping of space elements, incidence, connection, intersection. Intro-ducing new image planes. Orthogonal space elements, revolution of planes, metric problems. Polyhedra: representation, intersection with lines and planes, interpenetration. Representation of circles. Mapping of spheres, cones and cylinders of revolution, their intersection with lines and planes, interpenetration. The cylindrical helix, helicoid.
both	GEAGT002B-A	Descriptive Geometry	3	3	0	BSc	Óváriné Dr. habil. Balajti Zs	zsuzsanna.ovarine.balajti@uni-miskolc.hu	Mathematics	Monge's representation is the basis of true-to-scale engineering communication. Representation The introduction of Monge's representation as the basis of true-to-scale engineering communication. Representation and reconstruction of the base elements of the space. The mutual position, lying, parallelism and intersection of the base elements of the space. Transforming the representation of an object onto newly introduced projection planes to solve spatial construction tasks. Projection conditions of perpendicularity. Rotating a plane into a position parallel to the plane of projection to solve planar construction tasks. Determination of dimensions between the space elements. Representation of polyhedrals, and construction of the intersections with a straight line and a plane. Representation of a circle and a disc, a sphere, a cylinder of revolution, a cone of revolution, and the intersection of all these with a straight line and a plane. Affine and central collineation relations between conic sections. Intersections between the sphere, the cone and the cylinder. Helices and helicoid surfaces.
spring	GEALT177-Ma	Design of Material Handling Systems and Warehouses	5	2	2	MSc	Dr. Tamás Bányai	tamas.banyai@uni-miskolc.hu	Logistics	The course introduces students to the design methods of material handling and warehousing systems, enabling them to solve practical design problems.
autumn	GEIAL519-Ma	Development of Distributed Systems	5	2	2	MSc	Dr. Zoltán Krizsán	zoltan.krizsan@uni-miskolc.hu	Information Science	The students will learn the concepts and technologies of web-service oriented software development. Presentation of the platforrm and implementation independent component integration.
spring	GEMAN500-Ma	Differential Equations	5	2	2	MSc	Dr. Mihály Bessenyei	mihaly.bessenyei@uni-miskolc.hu	Mathematics	The theory of differential equations is a basic tool of diverse fields of science. Students of this course should be able to understand their behaviors and to derive solutions of differential equations. The analysis of differential equations includes numerical, geometrical and analytical methods. The course covers linear and nonlinear, and also ordinary and partial differential equations. Nonlinear equations are studied by their linearization around the equilibrium solution. A short introduction to complex functions is presented. Laplace and Fourier methods are applied both to ordinary and partial equations.
autumn	GEVAU195I-B2a	Digital Systems	5	2	2	BSc	Dr. József Vásárhelyi	jozsef.vásárhelyi@uni-miskolc.hu	Automation and Communication Techn	The subject presents the operation of the basic elements of embedded systems, making digital abstraction, developing skills for simple tasks with direct hardware, or low-level software solution. Through the presentation of binary arithmetic, the design of operators, functional units, and controllers, it reaches the description of the general-purpose microcontroller architecture, the use of elementary CPUs. Understand and design simple applications with microcontroller device with the use of standard peripherals. During the exercises and laboratory sessions related to the subject, the emphasis is on learning modern computer aided design methods and gaining direct, basic design/development experience.

autumn	GEMAN383-Ma	Discrete Mathematics and Applications	5	2	2	MSc	Prof. Dr. Sándor Radeleczki	sandor.radeleczki@uni-miskolc.hu	Mathematics	Pascal's triangle, Fibonacci numbers, semigroups and groups, Lagrange and Cauchy theorems for finite groups, rings and fields, number fields, the algebra of polynomials, Euclidean algorithm, irreducible factorizations of polynomials, introduction to graph-theory, trees, the greedy algorithm, planar graphs, the chromatic number, bipartite graphs, matchings, graphs and matrices, partial and linear orders, the order dimension of a poset, lattices and complete lattices, distributive and Boolean lattices, Boolean functions, polynomial form, disjunctive and conjunctive normal forms, clones of Boolean functions, maximal clones, completeness, Post lattice, De Morgan and Heyting algebras.
spring	GEMAN122-B2a	Discrete Mathematics II.	5	2	2	BSc	Dr. Sándor Radeleczki	sandor.radeleczki@uni-miskolc.hu	Mathematics	Theory of relations, fundamentals of graph theory. Connected components of a graph, trees, forests. Planar graphs, Euler's polyhedron formula and its corollaries: Kuratowski's theorem, characterization of bipartite graphs, independent edge sets (matchings), Kőnig's theorem, Hall's theorem, Ore's theorem. Existence of Eulerian path and Eulerian circuit, Hamiltonian path and Hamiltonian circuit. Graph coloring, chromatic number, four-color theorem. Adjacency and incidence matrices. Relations defined over sets, equivalence relations. Partial orders, partially ordered sets, chains and antichains. Linear extension of partially ordered sets. Lattices, the equivalence of the two defeinitions of lattices. Complemented, modular and distributive lattices and their characterization. Boolean algebra, Boolean functions and their normal forms.
spring	GEMET003-B2a	Dynamics	5	2	2	BSc	Dr. Edgár Bertóti	edgar.bertoti@uni-miskolc.hu	Mechanics	Kinematics of a particle. Kinematics of a rigid body: translation and rotation, relations for veloci-ties and accelerations. Relative-motion analysis of particles and rigid bodies. Kinetics of a parti-cle. Newton's laws of motion. Principle of impulse and momentum. Power and work of a force. Principle of work and energy. Conservative forces and potential energy. Equation of motion for a system of particles. Kinetics of a rigid body. Linear and angular momentum. Moments of inertia. Tensor of inertia. Newton-Euler equations of motion for a rigid body. Kinetic energy of a rigid body. Power and work of system of forces acting on a rigid body. D'Alembert's principle. Con-strained motions. Planar kinetics of a system of rigid bodies. One-degree-of-freedom vibration of a rigid body. Equation of motion, circular and natural frequency. Undamped, damped and forced vibrations. Resonance.
both	GEGTT 462-Ba	Efficiency improvement of manufacturing	3	2	1	BSc	Dr. György Kovács	gyorgy.kovacs@uni-miskolc.hu	Manufacturing Science	Aims, main activities and characteristics of production systems and processes. General types and characteristics of intermittent and continuous production processes: project production, job-shop production, batch production, mass production and process production. Performance measurement of production processes, most often used Key Performance Indicators (KPI). Main aims of the efficiency improvement of manufacturing processes. Analyzation methods of manufacturing processes. Efficiency improvement methods for processes: e.g. Lean, Facility Layout Design, Simulation, MTM (Methods-Time Measurement) methods. Case studies.
autumn	GEVEE050-B2a	Electrotechnics-Electronics	5	2	2	BSc	Dr. Judit Molnár	judit.molnar@uni-miskolc.hu	Physics and Electronic Engineering	Introducing the basic electrical and magnetic phenomena, laws and circuit calculations in the case of direct current, single and three-phase alternating current excited networks. Introducing the main characteristics of equipment used in electrical energy generation, distribution, conversion and utilization (one and three-phase transformers, one and three-phase synchronous and induction machines, DC machines). Introducing semiconductors, diode, transistor, rectifier circuits, power electronic converters.
autumn	GEVAU519B-A	Embedded Systems	5	2	2	BSc	Dr. József Vásárhelyi	vajo@uni-miskolc.hu	Automation and Communication techn	Embedded Systems overview Example Embedded Systems and their Requirements Processor technologies and IC technologies Design technologies Processors (custom single purpose general purpose and standard single purpose) Memory Interfacing Soft processors and hard processors (PicoBlaze MicroBlaze PowerPC ARM) Peripherals Embedded all programmable SOC Design Flow Embededd Development Kit Software debugging Event handlers timers System on a Chip Architecture and Code Structure A code walk through Board evaluation in software Board evaluation in hardware.
both	GEVEE533-B2a	Energy production and storage systems	5	2	2	BSc	Dr. Radányi László Ádám	laszlo.adam.radanyi@uni-miskolc.hu	Physics and Electronic Engineering	This course is an introduction of the energy storage possibilities. This is included gas power plant systems too and the method and calculations of natural and biogas combustion and gas power plant systems, powered by different gases. We will investigate the production of the energy by photovoltaic method.

spring	GEALT528-B2a	Engineering Calculations for Material Ha	5	2	2	BSc	Dr. Péter Telek	peter.telek@uni-miskolc.hu	Logistics	During the course, students are introduced to the design methods of material handling machines. The aim is to create the theoretical foundations necessary for the design of the equipment, with which you will be able to solve the problems that arise during practical application.
autumn	GEAHT321-B2a	Engineering Fluid Mechanics	3	2	1	BSc	Dr. Norbert Szaszák	norbert.szaszak@uni-miskolc.hu	Energy Engineering and Chemical Mach	Properties of liquids and gases: compressible/incompressible fluids. Ideal/real fluids, surface tension, capillarity. Hydrostatic law, pressure variation in fluids. Communicating vessels, ma-nometers, barometer. Pressure variation in the atmosphere. Hydrostatic thrust on submerged plane and curved surfaces. Kinematics of fluids, Lagrangian and Eulerian specification of the flow field. Streamline, streak line, path line, stream tube. continuity equation for steady flow, Ber-noulli's equation. Specific energy diagram, applications of the Bernoulli's equation: Venturi me-ter, orifice flow meter, Pitot-static tube. Discharge from open tank and pressurized vessel, time of discharge. Energy equation. Minor and major losses in piping systems. Moody diagram. Flow in channels. Hydraulic diameter, radius. Buoyancy force and drag in flow.
spring	GEAHT001-Ma	Engineering fluid mechanics and heat tra	5	2	2	MSc	Dr. Norbert Szaszák	norbert.szaszak@uni-miskolc.hu	Energy Engineering and Chemical Mach	General properties of fluids, surface tension, capillarity, Newton's law of viscosity. Hydrostatics, pressure variation in a fluid at rest. Thrust on submerged plane and curved surfaces. Continuity. Eulerian equation of motion. Bernoulli equation. Momentum theorem. Navier-Stokes equations. Friction losses in pipes, minor losses. Introduction to Computational Fluid Dynamics (CFD). Forms of heat transfer: conduction, convection, radiation. One-dimensional steady-state conduction in a composite wall or in cylindrical shells. Variable thermal conductivity. Convective heat transfer. Energy equation. Hydrodynamically and thermally developed laminar flow: Couette flow, flow and heat transfer in a pipe.
spring	GEAHT211-B2a	Engineering Thermodynamics	3	2	1	BSc	Dr. Péter Bencs	peter.bencs@uni-miskolc.hu	Energy Engineering and Chemical Mach	Basic concepts - Thermodynamic systems classification, state and state variables. Intense and extensive, specific and molar state variables. Equation of state. Theorem I of Thermodynamics - Internal energy, work of volume change, work of friction and total work. Heat, Principal Theorem I for stationary closed systems, Principal Theorem I for moving closed systems, Principal Theo-rem I for open systems. Entropy, exergy, anergy and the second law of thermodynamics. Cycles - The Carnot cycle, Thermal efficiency, Exergetic efficiency. Thermodynamics of pure media - The ideal gas, incompressible gas, state changes of the ideal gas. Energy conversion cycles - The Joule cycle, Steam working fluid cycles. Energy conversion cycles - Compressor refrigeration cycles. Energy conversion cycles - Combined cycle gas/steam, cogeneration. Heat transfer fundamentals - Heat conduction in a solid wall, Newton's law of heat transfer.
spring	GEIAK682-Ma	Enterprise Application Integration	5	2	2	MSc	Dr. Samad Dadvandipour	samad.dadvandipour@uni-miskolc.hu	Information Science	Enterprise Application Integration, or EAI, has existed as a technical term since the early 2000s, but the central problem that it attempts to solve is much older. In a nutshell, EAI is an approach, or more accurately, a general category of approaches, to providing interoperability between the multiple disparate systems that make up a typical enterprise infrastructure. Enterprise architectures, by their nature, tend to consist of many systems and applications, which provide the various services the company relies upon to conduct their day to day business. A single organization might use separate systems, either developed in-house or licensed from a third party vendor, to manage their supply chain, customer relationships, employee information, and business logic. This modularization is often desirable. In theory, breaking the task of running a business into multiple smaller functionalities allows for easy implementation of the best and newest technological advancements in each area, and quick adaptation to changing business needs. However, to gain the benefits of this kind of distributed, modular system, an organization must implement technologies that deal with the problems presented by this architecture.

autumn	GEVGT301-Ma	Environmental Management	5	2	1	MSc	Dr. Zoltán Szamosi	zoltan.szamosi@uni-miskolc.hu	Energy Engineering and Chemical Mach	The structure of the energy consumption, composition, energymix and the related problems. Energy sources and their usage and the distribution all around the globe. Possibilities of electricity production. The resources of energy sources and the possibility of the depletion time and their causes. The CO2 content in the atmosphere and the possible causes, possible ways to decreasing it. The alternatives of the fossil fuels. Nuclear energy. Hydro energy. Pump-storage hydro power plants: as an efficient way of energy storage. Biomass usage. Energy density increment technologies of biomass. Mechanical and thermal process. Possible biomass replacement of crude oil. Biomass as a plastic source.
both	GEGET065-Ba	Environmentally-friendly design	4	2	2	BSc	Dr. Ágnes Takács	agnes.takacs@uni-miskolc.hu	Machine and Product Design	Introduction to the DfE. Rules, strategies of the design for the environment. Learning the elements of environmentally frinedly design.
autumn	GEMET014B-a	Finite Element Method	4	2	2	BSc	Dr. Balázs Tóth	balazs.toth@uni-miskolc.hu	Mechanics	Principle of the stationarity of the total potential energy. Principle of the local approximation. Treatment of 2D and 3D elastic problems with isoparametric elements (shape functions stiffness matrix load vectors). The construction and characteristics of the system of linear equations. The problems of modelling: substructure technique the treatment of prescribed displacements excentric links oblique support bilateral contact - fitting of machine elements- and elastic foundation. Isoparametric thick plate element. Error analysis. , Theory of plasticity: Mises and Tresca-St.Venants yielding criteria postulates of Drucker and Prager Prandtl-Reusss equations and Levy-Misess theory. The formulation of the elastic-plastic constitutive matrix. Incremental formulation of the finite element equations using the principle of the virtual displacements. The theory of plastic limit loadings (static and kinematic). Elastic plastic torsion of rods (Nadays sand hill theory. FEM analysis of elastic-plastic plates.
spring	GEAHT431-B2a	Fluid Machinery	5	2	2	BSc	Dr. Norbert Szaszák	norbert.szaszak@uni-miskolc.hu	Energy Engineering and Chemical Mach	Categorization based on the direction of energy conversion: fans, pumps and turbines. Charac-teristic curve of pipes. Basic operating characteristics of pumps and turbines. Pump in a piping system. Operating characteristics of turbomachines. Principle of operation, characteristics, curves and regulation of turbopumps. Principle of operation, characteristics, curves and regulation of fans. Head, main properties and characteristic speed of impulse and reaction type water turbines. Hydrodynamic torque converter and hydrostatic transmission. Operation of turbocompressors. Main properties and fields of application of gas and steam tur-bines. Categorization of volumetric machines. Operating characteristics of reciprocating pumps, fluid delivery as a function of time, effect of air vessel. Reciprocating compressor. Radial and axial piston pumps. Types of rotating piston pumps, fluid delivery.
spring	GEAHT433-B2a	Fluid Transport Systems and Machines	5	2	2	BSc	Dr. Péter Bencs	peter.bencs@uni-miskolc.hu	Energy Engineering and Chemical Mach	Properties of fluids (density, velocity field, streamlines, potential function, vorticity vector). Equation of continuity. Bernoulli equation for ideal and non-ideal, incompressible and compressible flows. Flow losses in pipelines and fittings. Equivalent pipe length. Classification of machines. Main characteristics of flow machines. External energy diagram of working machines. Realistic characteristic curves of pumps. Suction power of pumps. Working point of pumps, series and parallel connection. Starting and control of pumps. Types of water turbines. Characteristic curves of water turbines. Energy diagram and characteristic curve of fans. Fan types.
spring	GEAGT121-B2a	Fundamentals of CAD	3	1	2	BSc	Sándor Lajos	sandor.lajos@uni-miskolc.hu	Mathematics	Basic concepts related to CAD systems. Structure, hardware and software components, basic functions of CAD systems. Computer aided drawing systems. Geometric modeling systems. Wireframe, surface and solid models. Representations of models, visibility algorithms, lighting, shading, photorealistic rendering. Parametric and direct modeling systems. Rapid prototyping methods. Learning basic solid model creation methods using a specific parametric design system (Creo Parametric). Creating parts, assemblies, mechanisms, animations and photorealistic imag-es, Create technical drawings of parts and assemblies.

autumn	GEGET001-B2a	Fundamentals of Machine Elements	4	2	2	BSc	Prof. Dr. Gabriella Vadászr	gabriella.v.bognar@uni-miskolc.hu	Machine and Product Design	Mechanical work and performance in motion on straight line. Sliding friction and rolling re-sistance. Weightlifting work, potentional energy. The law of conservation of energy in a closed mechanical system. The force of acceleration and inertia. Characteristics of rotating motion. Torque work and performance. Efficiency, machine losses, energy figures. Periodic motion of ma-chines. Bevel gear, crank gear. Determination of motion characteristics. Main types of gears. The flywheel, the degree of inequality. Drive systems. Friction drive. Flexible drive. Gear drive. Brakes, single-jaw and double-jaw brakes. Band brakes. Springs. The spring characteristic. Spring con-stant of a spring connected in series and in parallel.
autumn	GEGET101-B2a	Fundamentals of Machine Elements	4	2	2	BSc	Prof. Dr. Gabriella Vadászn	gabriella.v.bognar@uni-miskolc.hu	Machine and Product Design	The aim of the course is to summarize the most important basic principles of mechanical engineering, to present the basic physical and mechanical quantities, the concepts and methods necessary for the examination of machines and processes, and the way of negotiating engineering processes. The student learns about the smooth operation of machines, the calculation of efficiency and losses, different drives (friction, belt, gear drive), pulley and crank drives, as well as the basics of flow engineering processes, the Bernoulli equation, the Venturi tube, the real fluid flow losses, the movement conditions of springs and brakes.
spring	GEFIT021-B2a	Fundamentals of Physics	3	2	1	BSc	Dr. Gábor Pszota	gabor.pszota@uni-miskolc.hu	Physics and Electronic Engineering	Fundamental concepts of kinematics. Newton's laws. Power, work, energy. Linear free oscillation. Forced oscillation. Electric charge, field, potential. Conductors in electric field. The flow of electric charges. Concept of current density and current. Conduction of current in metals. DC circuits. The integral form of Joule's law. The concept of magnetic induction. Forces in magnetic field. Dia-, para-, and ferromagnetism. Ampere's law. Electromagnetic induction. Neumann's law. Faraday's law of induction. AC current. Ampere-Maxwell law. EM waves.
autumn	GEIAL311-B2a	Fundamentals of Programming	6	3	2	BSc	Dr. Baksáné Dr. Erika Varg	erika.b.varga@uni-miskolc.hu	Information Science	We will discuss the following topics: basics of computer programming, programming paradigms and programming languages, the operation of compilers and interpreters, steps of program development, how to develop an algorithm and how to implement it in C, basic concepts of structured programming and control structures. You will also learn about memory management, the scope and lifetime of variables and recursive problems. In practical classes you will learn the syntax and semantics of C programming constructs. You will work with primitive data types, pointers, arrays and structs. You will have excercises for reading from and writing to standard input/output and files, as well as for defininig and calling functions.
autumn	GEMTT302M-a	Fusion Welding	4	2	1	MSc	Raghawendra P. S. Sisodia	raghawendra.sisodia@uni-miskolc.hu	Materials Science and Technology	Fundamentals of joining. Theoretical bases of welding. Energy sources. Heat flow. Fluid flow phenomena. Transfer of heat and mass. Fundamentals of weld solidification. Solid-state transformations. Short overview of principal fusion welding processes: GTAW, SMAW, GMAW, SAW, FCAW and PAW. Advanced fusion welding processes: electron beam and laser beam welding. Application. Process planning.
spring	GEFIT001-B2a	General Physics I.	4	2	2	BSc	Dr. Gábor Pszota	gabor.pszota@uni-miskolc.hu	Physics and Electronic Engineering	Basic concepts of kinematics. Newton's laws. Work and power. Conservative fields, the law of me-chanical energy. The law of momentum. Torque. The law of angular momentum. Central force fields. Damped linear free oscillations. Forced oscillations. The law of momentum and angular momentum for a system of mass points. Euler description of continuous media. Continuity equation. Bernoulli equation. Thermodynamics of gases, solids, and liquids. Processes of ideal gases. First law of ther-modynamics. Entropy. Second law of thermodynamics. Cyclic processes.
autumn	GEFIT002-B2a	General Physics II.	3	2	1	BSc	Dr. Gábor Pszota	gabor.pszota@uni-miskolc.hu	Physics and Electronic Engineering	Electric charge, field, potential. Gauss' law. Conductors in a static electric field. The flow of electric charges. Voltage sources. Kirchhoff's laws. Joule's law. The concept of magnetic induction. Magnetic field strength. Dia-, para-, and ferromagnetism. The magnetic Gauss law. Ampere's law. Biot-Savart law. Neumann's law and Faraday's law. Displacement current. Ampere-Maxwell law. The system of Maxwell's equations. EM waves in homogeneous isotropic insulators.

both	GEAGT106-Ba	Geometric design	4	2	2	BSc	Óváriné Dr. habil. Balajti Zs	zsuzsanna.ovarine.balajti@uni-miskolc.hu	Mathematics	The aim of this course is to introduce the principles of the clear mapping of the 3 dimension into the 2 dimension and the reconstruction of objects from the images through real engineering examples to show students how to apply the descriptive geometry in engineering design. The Monge representation of the point, line, plane and their incidences (intersections). Parallelism and perpendicularity. Special views and rotation to particular position for metric problems. Intersection of pyramid and prism. Affin connection between the circle and its ellipse projection. Representation of the sphere surface normals and tangent planes. Intersection curves between the cylinders and cones. Helix and its evolvent surface with the spiral section in the perpendicular plane to the axis. Centroids, axoids.
spring	GEAGT232-Ma	Geometric Modelling and its applications	5	2	2	MSc	Imre Piller	imre.piller@uni-miskolc.hu	Mathematics	Description of curves, interpolating and approximating curves, spline curves. Osculating plane, arc length, curvature, torsion, Frenet frame. Definition and properties of Hermite arc, Ferguson and Overhauser splines. Parametric description and properties of Bézier curves, de Calteljau algorithm. Parametric form and properties of B-spline curves. Description of surfaces, tangent plane, normal, surfaces swept by a moving curve. Interpolating and approximating surfaces: Coons patch, Bézier and B-spline surfaces. Generation of rational Bézier and B-spline surfaces and their properties. Surface and solid modeling in CAD systems.
autumn	GESGT005-Ma	Hydraulic Units and Systems	5	2	2	MSc	Dr. György Hegedűs	gyorgy.hegedus@uni-miskolc.hu	Machine Tools and Mechatronics	Classification of hydraulic drives. Changing the motion characteristic by current flow and adjusting the specific working volume. Series and parallel connection of energy converters. Basic tasks in hydraulic systems: pump unloading, rapid switching, multi-pump, multi-pressure systems. Overload prevention, load holding, braking switching. Accumulator circuits. Losses in hydraulic circuits, heating of the working fluid. Tank sizing for heating. Proportional magnetically operated hydraulic elements. Structure and design of direct and pilot-operated pressure controllers, directional control valves. Proportional throttle and flow stabilizing elements. Aspects of proportional valve selection.
autumn	GESGT002-Ma	iCAD Systems 1	5	2	2	MSc	Dr. György Hegedűs	gyorgy.hegedus@uni-miskolc.hu	Machine Tools and Mechatronics	Structure of the integrated CAD systems, typical features. Managing processes in iCAD environment, typical strategies. Sketching, geometrical constraints, dimensioning. Part modelling. Different modelling techniques. Surface modelling principles. Creating assemblies, assembly constraints, assembling strategies. Documenting iCAD works. Possibilities for enhancement of the designing process, managing teamwork. Portability of CAD files, compliance between CAD systems, file types and conversions. Examples from the field of designing manufacturing devices.
spring	GEMTT071-Ma	iCAD Systems 2	5	2	2	MSc	Dr. Zsolt Lukács	zsolt.lukacs@uni-miskolc.hu	Material Science and Technology	Nowadays, different CAD/CAM solutions play a significant role in process planning of sheet metal products. In this course, first a general overview is given on CAD/CAM program systems and it will be demonstrated how these programs can help the process planning and die designer engineers' work. By the end of this course the students will acquire the fundamental knowledge: -in various types of CAD/CAM program systems -the basic principles of their working -the main input parameters need to be given and -the main results that can be achieved by using them. During the course two program codes used in process planning of sheet metal forming will be presented. The first one is the Autoform FEM code, which gives possibility of examining feasibility of process planning of sheet metal forming. The second one is NX Sheet Metal, which permits of planning of such parametric workpiece, which make design processing procedure faster.
autumn	GEVAU303-Ma	Industrial Automation	5	2	2	MSc	Dr. Attila Trohák	attila.trohak@uni-miskolc.hu	Automation and Communication Techn	Introducing the fundamentals of automated production and the role of Programmable Logic Controllers (PLC). Introducing the sensors which are able to provide information about pre manufacturing system and the actuators which are able to influence the production process. The types of Human Machine Interfaces (HMI) which can inform the operator about the machine. The wired and wireless communication methods providing data exchange with MES/ERP systems. Introducing the development method of unique production surveillance systems.
spring	GEGTT102-B2a	Industrial Machining	4	2	2	BSc	Dr. Csaba Felhő	csaba.felho@uni-miskolc.hu	Production Engineering	Machining procedures of flat and cylindrical surfaces, their kinematics, machines, tools and de-vices. Machining of shaped rotational surfaces and torque-transmitting surfaces. Procedures for the manufacturing of external and internal threads. Machining of different types of gear parts, e.g. spur gears, helical gears, straight and spiral bevel gears, internal gears. Manufacturing of worms and worm wheels. Determining the technological data of each machining, monitoring the processes. Introduction of service life-enhancing treatments. Description of non-traditional ma-chining processes.

autumn	GEALT173G-Ma	Industry 4.0 and Logistics	5	2	2	MSc	Dr. Bányainé Prof. Dr. Tóth	agota.banyaine@uni-miskolc.hu	Logistics	The Fourth Industrial Revolution will fundamentally change the operation of production and service systems, so within the course we aim to introduce students to the benefits of the Fourth Industrial Revolution as an Industry 4.0 system. Students will gain an overview of Industry 4.0 technologies, with a particular focus on cloud-based systems, cyber-physical systems, and smart factories. We focus on the impact of Industry 4.0 solutions in logistics. Through case studies, students will become familiar with logistics solutions operating in an Industry 4.0 economic environment. Our goal is to provide students with the theoretical knowledge required for Industry 4.0 applications.
spring	GEIAL550-Ma	Industry 4.0 Information Systems	5	2	2	MSc	Prof. Dr. László Kovács	laszlo.kovacs@uni-miskolc.hu	Information Science	Overview of the role of information systems in I4.0 architecture; Different types of applications (OLTP,OLAP). Foundation of data warehouses. MD models and operations, application areas. Web-based applications: architecture and application areas. Application of intelligent sensors, data analysis. Cloud and Big Data architectures, Application of blockchain technologies. Smart applications.
spring	GEIAK210-B2a	Information Technology for Engineers	4	2	2	BSc	Kunné Dr. Judit Tamás	judit.tamas@uni-miskolc.hu	Information Science	Introduction to graphics programming in C language. Deep knowledge of Excel, up to Visual Basic programming. Giving an overview of computer networks, databases. Introduction to the basics of using and programming MatLab: Introduction to the possibilities of Wolfram Alpha and the se-mantic web.
spring	GEMAK126-Ma	Information Theory and Cryptography	5	2	2	MSc	Dr. Sándor Fegyverneki	sandor.fegyverneki@uni-miskolc.hu	Mathematics	To master basic concepts in information theory, including source coding, and algorithms of channel capacity.To investigate important specific codes and channels. To continue to develop problem-solving skills and to apply these skills to the solving of application problems in communication theory.Be able to apply the gained knowledge to the solution of practical problems in engineering areas through evaluation and selection of appropriate statistical techniques. Specification: Source coding : entropy, I-divergence, classification of codes, Kraft-McMillan inequality, source coding theorem, Shannon-Fano coding, Gilbert-Moore coding, Huffman coding, Extended Huffman coding. McMillan's theorem Channel capacity: joint and conditional entropies, mutual information. types of discrete memoryless channels, BSC, BEC, channel capacity, Arimoto-Blahut algorithms. Channel coding: Hamming weight, Hamming distance, minimum distance decoding, single parity codes, Hamming codes, repetition codes, linear block codes, cyclic codes, syndrome calculation, encoder and decoder Continuous source, entropy, channels, minimum entropy method.
autumn	GEIAK120-B2a	Integrated ERP Systems	5	2	2	BSc	Dr. Samad Dadvandipour	samad.dadvandipour@uni-miskolc.hu	Information Science	The course topics include production planning, paying for or acquiring parts /spare parts, maintaining stocks, cooperating with suppliers, making customer services available, and following orders. ERP can also include application modules for a business's finance and human resources aspects. Some of the ERP subcontracting markets are J. D.Edwards, System Application and Production (SAP), People soft, as well as IBM, Microsoft, and Oracle
spring	GEIAL51C-Ma	Integrated Software Systems and Testing	5	2	2	MSc	Dr. Péter Mileff	peter.mileff@uni-miskolc.hu	Information Science	The course provides the theory and practice on the development of complex software systems, including sofware integration, software quality metrics and testing.
autumn	GEALT176-Ma	Intelligent Material Handling Machines and System	5	2	2	MSc	Dr. Péter Telek	peter.telek@uni-miskolc.hu	Logistics	Objective of the course is to present the intelligent material handling solutions for the students. The course gives an overview about the types, structures and operation of the automated handling machines applied in logistic processes.
spring	GEIAL529-Ma	Introduction into Datamining	5	2	2	MSc	Prof. Dr. László Kovács	laszlo.kovacs@uni-miskolc.hu	Information Science	Foundation of data management and data analysis. Basic skills in relational databases, Basic statistical tools for data analysis; Statistical tests and regression; introduction into data mining; Overview of the basic clustering and classification methods, introduction in neural networks, Learing how to use Excel, rapidMiner and Python for basic data analysis tasks,
spring	GEFIT010-B2a	Introduction into Physics	5	2	2	BSc	Dr. Gábor Pszota	gabor.pszota@uni-miskolc.hu	Physics and Electronic Engineering	Basic concepts of kinematics. Newton's laws, Momentum and its conservation, Work, energy, power. Conservative fields and potential energy. Torque. Equilibrium of rigid bodies. Free and forced linear oscillations. Hydrostatics. First law of thermodynamics. Thermodynamics of gases, solids, and liquids. Heat propagation. Electric charge, field, potential. Conductors in electrostatic field. The flow of electric charges. The concept of current, current density, voltage. Voltage sources, electromotive force. DC circuits. Joule's law. The concept of magnetic induction. Forces in a magnetic field. Dia-, para-, and ferromagnetism. Ampere's law. Electromagnetic induction. Neumann's law. Faraday's law of induction. AC circuits. Ampere-Maxwell law. EM waves.

spring	GEAGT123-B2a	Introduction to CAD Systems	5	2	2	BSc	Sándor Lajos	sandor.lajos@uni-miskolc.hu	Mathematics	Learning the geometric and graphic background of CAD systems, as well as the basic solid and surface modeling methods. Learning basic solid model creation methods using a specific parametric design system (Creo Parametric). Creating assemblies, mechanisms and animations, creating photorealistic images, 3D printing. Import and export models.
both	GEIAK132B-a	Introduction to Neural Network	5	3	1	BSc	Dr. Samad Dadvandipour	samad.dadvandipour@uni-miskolc.hu	Information Science	Work on artificial neural networks commonly referred to as neural networks has been motivated right from its inception by the recognition that the brain computes in entirely different way from the conventional digital computer. The fundamentals of Artificial Neural Network (ANN) covers mainly the structural levels of organization in the brain models of a neuron neural networks viewed as directed graphs feedback network architectures knowledge representation visualizing process in neural networks artificial intelligence and neural networks and historical problems. Furthermore learning process and perceptron as basic conciderations are the essential parts at study of neural network.
spring	GEIAL31A-B2a	Java Programming	5	2	2	BSc	Dr. Tamás Tompa	tamas.tompa@uni-miskolc.hu	Information Science	The course helps deepen object-oriented programming knowledge and application of these methodology in Java techniques. Course topics: Effective use of basic Java classes (The java.lang package classes). Using collections. I/O programming (Streams, filter streams, pipes (Pipes), file access, File class). Internationality. Network management. Other technologies.
spring	GEVGTLCA-a	Life Cycle Assessment (LCA)	4	2	2	BSc; MSc	Dr. Zoltán Szamosi	zoltan.szamosi@uni-miskolc.hu	Energy Engineering and Chemical Mach	The role of life cycle assessment in environmental management. Phases of LCA. Writing input-output scales for technological processes. Life Cycle Inventory (LCI) analysis. Life Cycle Impact Assessment (LCIA) methods. Design of innovative environmental technologies with GaBi software. Normalization and weighting methods. Environmental economics study and evaluation of technological processes. Product life cycle analysis. Life Cycle Thinking (LCT), Life Cycle Management (LCM), Holistic decision making, Environmental LCA (E-LCA), Life Cycle Costing (LCC), and Life Cycle Sustainability Assessment (LCSA).
autumn	GEMAN203-B2a	Linear Algebra	5	2	2	BSc	Dr. Laura Veres	laura.veres@uni-miskolc.hu	Mathematics	Vectors in 2D and 3D, vector algebra, norm, dot product, projection, cross product, lines and planes. Vector Spaces, subspaces, linear independence, bases, dimension. Pivot table techniques. Matrices and matrix operations, rules of matrix arithmetic, different methods of finding the inverse, determinant. Introduction to systems of linear equations, Homogeneous and inho-mogeneous systems, Gaussian elimination, pivot table technique. Complex numbers, general form, polar form, operations with complex numbers, polynomials, operations, Horner scheme.
autumn	GEMAN213-B2a	Linear Algebra	5	2	2	BSc	Dr. Béla Kovács	bela.kovacs@uni-miskolc.hu	Mathematics	A concise but informative description of the knowledge to be acquired. The 3-dimensional real vectorspace, vector algebra, equations of straight and plane, vector spaces, linear dependence, independence, base, dimension, complex numbers, operation, polynomials, operations radical factor shape, matrices, matrix operations, matrix rank, determinant, matrix inverse, base transformation, homogeneous and inhomogeneous systems of linear equations, solvability, solution methods, linear mappings, characteristic polynomial, eigenvector, eigenvalue, diagonalizability, the real number n's are spaces.
autumn	GEMAN102-B2a	Linear Algebra and Discrete Mathematics	6	3	2	BSc	Dr. Sándor Radeleczki	sandor.radeleczki@uni-miskolc.hu	Mathematics	Sets of numbers, the Cartesian product of sets, binary relations and their graphs, the inverse of a binary relation, the notion of a function, composition of the functions, bijective and inverse functions, permutations, operations with permutations. The notion of a semigroup and group. Operations with polinomials, the notion of a ring and of a field. The division of polinomials and of the integers, Euclidean algorithm. Operation with matrices, their ring. Determinants, Crammer's rule. The notion of a complex number, operations with complex numbers in trigonometric form, Moivre's formula. Vectors in the plane and space, operations with vectors, geometrical interpretation of the vectorial and of the mixed product of space vectors, n-dimensional vectors. The notion of a linear space, subspaces, linearly independent systems of vectors, generator system and base in a linear space. The dimension of a vector space, the rank of a matrix, linear transformations and their matrices, the composition and the inverse of linear transformations, systems of linear equasion, their solutions, Gauss method, Rank theorem. Eigen values and eigenvectors.
autumn	GEALT504-B2a	Logistics Systems	4	2	2	BSc	Dr. Bányainé Dr. Ágota Tót	agota.banyaine@uni-miskolc.hu	Logistics	The course introduces students to the planning and management methods of the various subsystems of the enterprise logistics system. The course will introduce the structure and main elements of the enterprise logistics system. The aim is to provide the theoretical basis for the optimal design and operation of logistics systems and to introduce the design principles, which can be further developed in the Master's programme.

both	GEGET015-Ba	Lubrication and Sealing	4	2	2	BSc	Géza Németh	geza.nemeth@uni-miskolc.hu	Machine and Product Design	Lubrication, lubrication conditions, lubricants, lubricant characteristics, lubricant tests, lubrication of machine parts. Lubricators. Static and dynamic seals, sealing problems. Analysis of complex lubrication and sealing systems.
autumn	GEGET003-B2a	Machine Elements I.	4	2	2	BSc	Dr. Ferenc Sarka	ferenc.sarka@uni-miskolc.hu	Machine and Product Design	The aim of the course is to familiarize students with basic machine components. Get to know their operation and properties. Know their sizing, checking or selection. With the help of mid-year tasks, mastering the basic level of planning and construction. Basic principles of sizing ma-chine components. Connection methods, detachable and non-detachable joints. Dimensioning of mover and tie screws. Couplings. Springs. Dimensioning of shafts. Basics of tribology. Friction, wear, lubrication. Dimensioning and structural designs of sliding bearings. Rolling bearings and their selection. Mechanical drives, their grouping, their most important characteristics. Flexible drives. Gaskets.
spring	GEGET004-B2a	Machine Elements II.	5	2	2	BSc	Dr. Károly Jálics	karoly.jalics@uni-miskolc.hu	Machine and Product Design	Expansion and application of the knowledge acquired from the Mechanical Drawing, and Ma-chine Elements I subject. Familiarization and calculation of toothed machine elements (spur, helical, bevel, internal gears, worm drives), manufacturing of gears. Crank mechanisms, flexible drives, Design issues of transmissions.
spring	GEGET501-Ma	Machine Structures and Design	5	2	2	MSc	Dr. Ferenc Sarka	ferenc.sarka@uni-miskolc.hu	Machine and Product Design	Significant computations to eliminate the fatigue failure. Fundamentals of design theory and methodology. Gear drives connecting intersecting axes. Geometrical design and manufacturing methods for bevel gears. Kinematics of epicycle gear drives. Geometric and strength calculation of epicycle gear drives. Construction of epicycle gear drives. Types of flexible gear drives. Strength calculation of flexible gear.
spring	GESGT001-B2a	Machine Tools	4	2	2	BSc	Dr. György Hegedűs	gyorgy.hegedus@uni-miskolc.hu	Machine Tools and Mechatronics	Definition of machine tools. The development history of machine tools and their impact on in-dustrial culture and economic progress. Grouping the division of machine tools. The structural design and main building units of machine tools. Characteristics of the design of main and sec-ondary drives. Description of lathe-type machine tools. Description of milling machines, planers, chisels, drilling machines, horizon type machines. Description of abrasive machining machines. Description of gear and thread processing machines. Drilling and milling centers. Description of turning centers. Description of plastic forming machine tools. Description of high energy density radial machine tools and spark cutting machines. Description of rapid prototype technologies and machines. Description of wiring systems used on machine tools. Theory of machine industry measurements applicable to machine tools.
spring	GEGTT800-Ma	Manufacturing Processes and Systems	5	2	2	MSc	Dr. Csaba Felhő	csaba.felho@uni-miskolc.hu	Production Engineering	Basic concepts and main characteristics of manufacturing processes and systems. The main tasks of technological design and production planning, and the relationship between them. The theoretical basis for technological design, regularities and methodology. Process and information background of technology pre-planning, operation sequence, operation and operation-element planning. Impact of the manufacturing environment to the technology planning. The modern technological procedures, tools and techniques of machinery. Types and structure of manufacturing systems. Technological, organizational and methodological fundamentals of manufacturing system design. Systems of the flexible automated manufacturing. Optimization and simulation in design of manufacturing processes and systems.
autumn	GEGTT100-B2a	Manufacturing Technology	5	2	2	BSc	Dr. Csaba Felhő	csaba.felho@uni-miskolc.hu	Production Engineering	Main scientific fields, basic terms structure and systems approach characteristics of manufactur-ing technology. Manufacturing éd technological process. Cutting by tools with define edge geom-etry. Main characteristics of chip removal. Basic elements, workpiece, tool, movements cutting parameters. Role of bases and dimension chains in manufacturing technology. Edge geometry materials of cutting tools. Wear and tool life of cutting tools. Main cutting methods: turning, shaping, drilling, boring, face- and slab milling. Fine machining methods, grinding superfinish-ing, honing, lapping, polishing. Machine industrial measurements and their tools. Mechanical, optical, electrical and laser measuring devices used in length and angle measurements.

autumn	GEALT502-B2a	Material Handling Machines	4	2	2	BSc	Dr. Péter Telek	peter.telek@uni-miskolc.hu	Logistics	Main objective of the course is to present the types, operation characteristics and elements of material handling machines for the students. During the semester the planning, operation and maintenance aspects of the machines are also presented. At the end of the course, students gain sufficient knowledge for the application, operation and control of handling machines. During the practical lessons students get deeper knowledge about the machines and apply the theoretical methods.
autumn	GEMTT003-B2a	Material Technologies	5	2	3	BSc	Dr. Ákos Meilinger	akos.meilinger@uni-miskolc.hu	Materials Science and Technology	Definition of heat treatment, groups of heat treating technologies. Microstructural changes dur-ing heat treatment. Heat treating processes for hardness and strength increase. Hardenability. Machinability improving by heat treatment. Heat treatment processes for toughness increase. Annealings. Thermochemical heat treatments. Microstructural changes during thermochemical heat treatments. Planning of heat treating technologies. Heat treating equipments. Mass effect in case of heat treating. Welding and related technologies. Definition and classification of welding. Energy sources of welding. Characteristics of heat sources. Properties of welding seam and heat affected zone. The electric arc. Manual metal arc welding and submerged arc welding: principles, characteristics, technologies, welding materials, equipments and applications. Metal active/inert gas and tungsten inert gas welding processes: principles, characteristics, technologies, welding materials, equipments and applications. Pressure welding processes. Characteristics of re-sistance spot welding, electrode geometries and materials, schedules. Resistance projection and seam welding. Material science background of forming. Cutting technology planning. Layout and strip plans, determination of technological parameters for cutting. Cutting tools. Planning of bending technologies and characteristics. Bending tools. Deep drawing technology planning: number of drawings, drawing tools. Production planning with serial drawing tools. The techno-logical process of cold extrusion and cold compression, the steps of their technological design. Characteristics of forging technologies, design principles for forging. Forming machines, princi-ples of machine selection. Processing of plastics: extrusion, injection molding, overview of their technological design and tools.
spring	GEMTT001-Ma	Materials Science	5	2	2	MSc	Dr. Sisodia Raghawendra P	raghawendra.sisodia@uni-miskolc.hu	Material Science and Technology	The main groups of materials: fundamental materials (metals, ceramics, polymers) and their relative importance. Basic knowledge of structure of materials: crystalline and amorphous structures of metals, ceramics and polymers; main types of composites concerning their composition, structure and morphology. Properties and application fields: structure related specific properties of metals, ceramics and polymers; engineering application of monolithic and composite materials, Mechanical behaviour: physical background of the mechanical behaviour of the different group of materials, deformation mechanisms, material models; the characteristic application related failure mechanisms of the main groups of materials. The relationship between the structure/processing/properties and functional performance and their interactions. Development trends in materials sciences. Strenghtening of metallic materials, toughening of ceramics, selective polymer design for specific applications of polymers. Environment protection, recycling.
autumn	GEMTT201-B2a	Materials Science and Testing	4	2	2	BSc	Dr. Péter Kovács	peter.kovacs@uni-miskolc.hu	Materials Science and Technology	Introduction to material-related engineering concepts, acquisition of the basic knowledge necessary to develop an engineering approach, definition of the main material properties and an overview of their definition options, exploration of the relationship system of material properties and material structure and the principle possibilities of modifying properties.
autumn	GEMTT074-Ma	Materials Selection	5	2	2	MSc	Dr. László Kuzsella	laszlo.kuzsella@uni-miskolc.hu	Material Science and Technology	The role of materials selection in fulfilling functional, technological, economical and environmental aspects in design, process planning and manufacturing processes. Effect of material properties on design and manufacturing processes, and on the reliability of engineering structures. The development and evolution of material selection procedures. The nature of the selection process. Computer Aided Materials and Process selection. Conventional and electronic material databases. Sources of information on materials. Procedures for implementing networked materials database systems.

autumn	GEMAN151-B2a	Mathematical Analysis I.	5	3	2	BSc	Dr. Szilvia Árvai-Homolya	szilvia.homolya@uni-miskolc.hu	Mathematics	Sets, operations on sets. Relations, functions. Real numbers and their properties. Topology of real numbers. Sequences of real numbers and their properties. Convergent sequences, Series of real numbers. Convergence criteria for series. Concepts of single variable function, limits, continuity. Elementary functions. Differentiation: derivative of elementary functions, differentiation rules, Applications: L'Hospital rule, extreme value calculation, function analysis. Curves given in parametric and polar coordinates.
spring	GEMAN161-B2a	Mathematical Analysis II.	5	3	2	BSc	Dr. Szilvia Árvai-Homolya	szilvia.homolya@uni-miskolc.hu	Mathematics	Indefinite integrals, basic integrals, techniques of integration. Riemann condition of integrability. The Newton-Leibniz theorem, improper integrals, applications of the definite integral. Real multivariable functions. Partial derivatives of multivariable functions, directional and partial derivatives. Extreme value of multivariable functions. The concept, properties and calculation of the double integral. Change of variables in double integrals, Applications of the double integral: volume, area, surface calculation. Interpretation, properties and calculation of the triple integral. Introduction of new variables (cylindrical and spherical coordinate system). Applications of the triple integral. Differential equations. Ordinary differential equations of the first order. Higher order differential equations.
autumn	GEMAN101BA	Mathematics for Economic Analysis I.	4	2	2	BSc	Dr. Péter Varga	peter.varga@uni-miskolc.hu	Mathematics	Introduction to the basic concepts of calculus and their applications. Functions derivatives and limits, the definite integral. Techniques of integration applications of integration. Introduction to single variable probability. Random variables. Distributions.,
autumn	GEMAN610-B2a	Mathematics in Logistics I.	6	2	2	BSc	Dr. Krisztián Hriczó	krisztian.hriczo@uni-miskolc.hu	Mathematics	Set theory, relations, functions, range of interpretation, set of values, series, limit of series, limit of univariate real functions, continuity, notable curves, differential calculus and its applications, function testing, indefinite integral calculus, rules of integration. The definite integral and its applications, impropius integral.
spring	GEMAN620-B2a	Mathematics in Logistics II.	5	2	2	BSc	Dr. Krisztián Hriczó	krisztian.hriczo@uni-miskolc.hu	Mathematics	The definite integral, its properties, areas of application. Improprius integrals. Bivariate functions. Numeric rows. Dual integral and its applications. Triple integral and its applications. Differential equations. Vector-scalar functions. Scalar vector functions. Vector-vector functions.
spring	GEVEE201-Ma	Measurement, Signal Processing and Elec	5	2	2	MSc	Dr. Dávid Matusz-Kalász	david.matusz-kalasz@uni-miskolc.hu	Physics and Electronic Engineering	The aim of this course is to provide deep understanding of the theory and operation of modern measurement systems. Students learn Electronic principles to build measuring instruments from. Lectures cover structure and operation of semiconductor devices, properties and parameters of amplifier circuits, passive and active filter configurations, operational and instrumentation amplifiers, properties and operation of different type of sensors and transducers, measurement theory, types and operation of analog instruments, process and building blocks of analog to digital converters, signal processing theorems and principles. Students gain practical laboratory experiences in measurements with instruments, building and testing simple electronic circuits and doing simple signal processing tasks.
spring	GEGET002-B2a	Mechanical Drawing	4	2	2	BSc	Dr. Zoltán Bihari	zoltan.bihari@uni-miskolc.hu	Machine and Product Design	Technical drawing is the international language of communication between technical profes-sionals. The technical drawing is a system of rules, the elements of which are fixed by interna-tional standards. In the framework of the subject, the rules applicable to the field of mechanical engineering will be presented. In addition to the general representation rules, the drawing rules of the most important machine elements are also explained, as well as the special solutions re-quired for machine design.
spring	GEGET285-B2a	Mechanical Engineering Knowledge	5	2	2	BSc	Dr. Zoltán Bihari	zoltan.bihari@uni-miskolc.hu	Machine and Product Design	The aim of the course is to acquaint students with the various machines, machine elements, their mechanism of operation and to use the basic physical connections in practice.
spring	GEMTT202-B2a	Mechanical Technologies	4	2	2	BSc	Dr. László Kuzsella	laszlo.kuzsella@uni-miskolc.hu	Materials Science and Technology	Introduction to material technologies, such as heat treatment, forming, casting and welding of materials. It describes the theoretical background and the most relevant technologies beside of these fields.

autumn	GEMET101-Ma	Mechanical Vibrations	5	2	2	MSc	Dr. László Péter Kiss	laszlo.kiss@uni-miskolc.hu	Mechanics	Principles of modelling dynamical systems. Central and eccentric impact of rigid bodies, the Maxwelldiagram. Modelling of mechanical vibrations, methods for the derivation and solution of the equations of motion. Vibrating systems with one degree of freedom (free vibrations, forced vibrations, damped freeand damped forced vibrations). Vertical vibrations of machine foundations. Active systems of vibration protection. Vibration of discrete systems with more degrees of freedom (equations of motion, natural frequencies, vibration modes). Eigenvalue-problems and their solutions, properties of the eigenvalues and eigenvectors. Vibration of continuous systems. Longitudinal-, bending- and torsional vibrations of elastic beams. Rayleigh-damping. Critical angular speed of rotating shafts. Laval problems. Bearing reactions of rotating shaft-bearing systems. Dynamic analysis of slider-crank mechanisms. Balancing of a multicylinder engine. Introduction to the measurement of dynamical parameters. The subject covers the fundamental principles and methods necessary to understand, analyse and solve different vibration problems and to make correct modelling decisions in the finite element simulations of vibrational problems in mechanical engineering.
autumn	GEMET266-B2a	Mechanics	5	2	2	BSc	Dr. Dávid Gönczi	david.gonczi@uni-miskolc.hu	Mechanics	Introduction, basic concepts. The task and main models of mechanics. Statics of a material point. The moment of a concentrated force calculated on a point or axis. Force system acting on a rigid body. Balance and equivalence of force systems. Distributive power systems. Static moment, center of mass. Static problems of simple and complex structures. Stresses of bars. Stress diagrams of straight supports. Basic solids concepts. Characteristics of the displacement, deformation, stress and energetic state of a solid body. Simple uses of bars. Pulling a prismatic rod. Twisting of a prismatic rod with circular and ring cross-section. Mechanical characteristics of ski ridges. Bending of a prismatic rod. Complex stresses of prismatic bars. General issues of dimensioning and control. Mohr's stress circle diagram.
autumn	GEMET002-B2a	Mechanics of Materials	5	2	2	BSc	Dr. Sándor Szirbik	sandor.szirbik@uni-miskolc.hu	Mechanics	Basic concepts of mechanics of materials. Introduction to matrix and tensor algebra. Deformable bodies. Deformation gradient, displacement gradient. Strain tensor and rotation tensor. Stress tensor. The tension-compression test. Hooke's law, Poisson's ratio. Strain energy. Elastic defor-mation of an axially loaded member. Torsion of circular shafts. Bending of straight members. Shear in straight members. Moments of inertia for an area. Combined loading, design of beams and shafts. General equations of elasticity: equilibrium equations, kinematic equations, general-ized Hooke's law. Mohr's circle. Principal stresses and strains. The concept of equivalent stress. Theories of failure. Deflection of beams and shafts. Curved beams. Statically indeterminate beams and shafts. Buckling and stability of columns.
both	GEMRB004B-a	Mechatronic Systems	4	2	2	BSc	Dr. László Rónai, József Lén	laszlo.ronai@uni-miskolc.hu, lenart.jozsef@	Machine Tools and Mechatronics	The structures and properties of mechatronics systems. Discussing the BIBO stability of LTI systems. Creating the state-space representation of systems. Laplace transformation to produce the transfer function of a system. Designing steps of the pole placement method. Introduction to PLC programming with the use of Rexroth ctrlX PLC, Rexroth ctrlX software. Programming of simple, practical tasks to learn the Ladder diagram, Sequential Function Chart, Function Block diagram and Continuous Function Chart programming languages.
spring	GEALT196-Ma	Mechatronics in Logistics	5	2	2	MSc	Dr. Ákos Cservenák	akos.cservenak@uni-miskolc.hu	Logistics	Nowadays, in logistics, material handling cannot be carried out without the use of various mechatronic equipment and tools. The aim of the course is to present the concept and subject areas of mechatronics to students of logistics engineering. Mechatronics covers three main disciplines, and the subject presents them as well. Another element of the subject is the fit of mechatronics into logistics.

autumn	GESGT003-Ma	Methodical Design	5	2	2	MSc	Dr. György Hegedűs	gyorgy.hegedus@uni-miskolc.hu	Machine Tools and Mechatronics	Progression of design methodology. Various design approaches, models and their quality aspects. Development of CAD systems. Ranges of the CAD, various CAxx technologies. Development flow chart of manufacturing devices. The design requirement lists. Defining functions and function structures. Methods of finding solution principles. Methods of combining and selecting solution principles. The step of designing in case of manufacturing devices, digital prototype. The design rules. The rules of productioncorrect design, DFM(x) requirements. Reverse-engineering design technique. Rapid-prototyping technologies. Rapid tooling technologies. Safety in design (ISO standards).
spring	GEIAL51D-Ma	Mobile and IoT Application Development	4	2	2	MSc	Dr. Anita Agárdi	anita.agardi@uni-miskolc.hu	Information Science	The purpose of the Mobile Application Developement is to learn the basic programming techniques on Android systems. The main topics are the followings: Android basics, overview, Structure of Android applications, building graphical user interfaces, making animations, putting vector graphics, media elements into user interface, overview of activities, fragments, intents, services, broadcase receivers, passing parameters to activities, fragments, handling return values, overview of data binding framework, calling web services, introducing google play services, overview of sensors of devices, publishing applications into Google Play Store.
spring	GEALT197-Ma	Modeling and Simulation of Transport Systems	4	2	2	MSc	Dr. Róbert Skapinyecz	robert.skapinyecz@uni-miskolc.hu	Logistics	During the course, students will be introduced to the structure of the road transport system, the basics of road traffic and public transport modeling, the use of modern traffic simulation and traffic planning software, and the application possibilities of the latter.
spring	GEIAL521G-Ma	Modern Database Systems	5	2	2	MSc	Prof. Dr. László Kovács	laszlo.kovacs@uni-miskolc.hu	Information Science	Overview of DB datamodels; Relational databases; PL/SQL; Hierarchical models: XML database, LDAP database and Java API; LINQ interface, Lambda calculus; ORM systems, Hypenate and myBatis; ORDBMS model and SQL commands; MongoDB datamodel, CRUD commands, database API in Java, Neo4J datamodel, CRUD commands, database API in Java, Cloud databases; overview of Hadoop , HDFS and mapReduce.
autumn	GEIAL551-Ma	Modern Information Technologies	5	2	2	MSc	Prof. Dr. László Kovács	laszlo.kovacs@uni-miskolc.hu	Information Science	The subject introduces one of the critical points of information systems, the concepts of computer security, the components used for security purposes, and their role. It explains the principles and basics of encryption in more detail. It covers public key cryptography and its role. In the second part of the course, basic programming techniques that can be used to automate business processes using MS Excel are presented.
both	GEFIT005M-a	Modern physics	3	2	0	MSc	Dr. Endre Kovács	endre.kovacs@uni-miskolc.hu	Physics and Electronic Engineering	Experimental basis of quantum physics, Blackbody radiation, photoelectric effect. Bohr's model. Lab demonstration. Wave-particle duality of particles. Wave functions and operators. The Schrödinger equation. The Heisenberg uncertainty principle. Quantum tunnelling. Quantum statistics. Structure of atoms and molecules. Nuclear physics, radioactive decay. Nuclear energy production. Fundamentals of solid state physics: Band theory of solids. Semiconductors, diodes, transistors. Superconductivity. Graphene and silicene.
spring	GEFIT014-B2a	Modern Physics	2	2		BSc	Dr. Gábor Pszota	gabor.pszota@uni-miskolc.hu	Physics and Electronic Engineering	Some basic concepts of special relativity. Conservative fields. Experimental foundations of quantum mechanics (black body radiation, photoelectric effect, relativistic effects). Matter waves, uncertainty relations. Fundamentals of quantum physics. The structure of atoms, systems with one or more electrons, chemical bonds, energy levels, band structure. Atomic physics fundamentals of lasers. Radioactivity, basics of nuclear physics. Reactors. Particle accelerators, interaction between radiation and matter.
spring	GESGT004-Ma	NC programming	5	2	2	MSc	Dr. György Hegedűs	gyorgy.hegedus@uni-miskolc.hu	Machine Tools and Mechatronics	Programming methods of NC machine tools: manual programming, WOP, computer aided programming. Advantages and disadvantages of methods. Process of computer aided NC programming. Introduction to Topsolid program. Menus, windows, bars. Machine and control definition. File handling. Importing and drawing the geometry. Editing the geometry. Coordinate systems, views. Solids, solid operations. Technological operations, handling of operation manager. Tool choice. Machining parameters, setup of work piece. Toolpathes in milling machines. Checking the NC program. Postprocessing, editing the NC program. Documentation, setup sheets. Examples.

spring	GEMTT075-Ma	Numerical and Physical Simulation of We	1	2	0	MSc	Dr. Sisodia Raghawendra P	raghawendra.sisodia@uni-miskolc.hu	Material Science and Technology	Introduction to materials science, welding processes and its importance in various industries; Types of joints and design guidance, Fundamental of heat transfer in welding; Weldability, thermal cycle, cooling time concept, Welding metallurgy: phase transformation and grain growth during welding; Introduction to thermal analysis in welding, Physical simulation (Gleeble); Physical simulation experimental demonstration with Gleeble: HAZ simulation; Case studies: Physical simulation to study weldability; Introduction to numerical simulation, software for welding (Simufact, SYSWELD etc.); Hands on demonstration of using simulation software (SYSWELD); Basic joint geometry, 2D, 3D- meshing, heat source model, model-ling, thermal analysis; EBW joint simulation, thermal and mechanical analysis.
autumn	GEMAK631-B2a	Numerical Methods	5	2	2	BSc	Dr. Attila Körei	attila.korei@uni-miskolc.hu	Mathematics	1. Basic elements of model building. Types of errors, classical error analysis. Error propagation. 2. Vector and matrix norms. Linear algebraic equations. Gauss elimination. 3. LU and Cholesky decomposition. Matrix inversion. 4. Jacobi and Seidel iteration. 5. Eigenvalues and eigenvectors, The power method. 6. Roots of equations: bisection method, fixed-point iteration, Newton method. 7. Curve fitting: Lagrange interpolating polynomials. 8. Least-squares regression. 9-10. Numerical differentiation and integration. 11-12. Runge-Kutta methods for solving ordinary differential equations. 13-14. Using Matlab (Octave) in solving numerical problems.
autumn	GEMAK116-Ma	Numerical Methods and Optimization	5	2	2	MSc	Dr. Attila Körei	attila.korei@uni-miskolc.hu	Mathematics	To provide suitable and effective methods for obtaining approximate representative numerical results of the problems. To solve complex mathematical problems using only simple arithmetic operations. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems. To improve the student's skills in numerical methods and optimization by using computer facilities.
spring	GEIAL313-B2a	Object Oriented Programming	5	2	2	BSc	Dr. Baksáné Dr. Erika Varg	erika.b.varga@uni-miskolc.hu	Information Science	In the lectures we will discuss the four basic principles of object oriented programming: encapsulation, information hiding, inheritance and polimorfism; and you will learn the syntax and semantics of Java and C# constructs. In practical classes you will use either Java or C# to work with classes, constructors, and methods. You will use encapsulation to improve the robustness of the code and reduce the impact of change. You will re-use code using inheritance and composition, so as to understand the problems with inheritance and how composition solves these problems. You will also develop loosely-coupled, testable and extensible applications using interfaces. The course also covers advanced concepts like exception handling, string handling, file handling and basic utility classes.
spring	GEALT501-B2a	Occupational Health and Safety in Logist	2	2		BSc	Dr. Róbert Skapinyecz	robert.skapinyecz@uni-miskolc.hu	Logistics	The place and role of occupational health and safety in logistics. Getting to know the basic workplace hazards, as well as the basic methods and procedures for minimizing the risks they pose in relation to material handling systems. Getting to know the comprehensive organization and main areas of application of the relevant standards, provisions and regulations. Presentation of examples of correct and incorrect occupational health and safety practices.
spring	GEIAL302-B2a	Operating Systems	5	2	2	BSc	Dr. Attila Baksa	attila.baksa@uni-miskolc.hu	Mechanics	Having knowledge about the operation and the implementation's technology of hardware and software components in information systems, as well as how to solve tasks arising from their operation, and how to connect them with other technical systems. Having knowledge about the terminology and specific expressions used by software engineers in English.
autumn	GEMAK001B-a	Operation Research	2	4	0	BSc	Dr. Attila Körei	attila.korei@uni-miskolc.hu	Mathematics	Introduction to optimisation models. Graphical solution to simple LP problems. Simplex method. Duality and sensitivity analysis. Solving the transportation problem by the distribution method. Assignment problem and its solution by the Hungarian method. Special integer programming problems.

autumn	GEIAL501-Ma	Operation Systems and Networks	5	2	2	MSc	Prof. Dr. Szilveszter Kovács	szilveszter.kovacs@uni-miskolc.hu	Information Science	Introduction to mainframe architectures and data center technologies (hardware redundancy, efficient data storage, clustering, data center architecture and operation, managing backups). Overview of supercomputing and high performance computing (HPC): Massive Parallel Processing, Single System Image, high-performance interconnects (InfiniBand, RDMA) supercomputers and applications. Storage Area Networks (SANs): Fibre Channel, iSCSI. Basics of real-time operating systems (RTOS). Details of virtualization technologies: emulation, kernel-based (containers), para-virtualization, hardware assisted virtualization, cloud technologies. Overview of the advanced features of modern file systems. Analysis of the TCP/IP Computer Networks architecture. Theoretical and design aspects. Special elements of Network layer (IPv4 and IPv6) addressing schemes; Routing Concepts; Static and Dynamic Routing; Switched Networks; VLANs; DHCP; NAT for IPv4.
spring	GEFIT003M-A	Physical Basis of Information Technology	2	2	0	MSc	Dr. Endre Kovács	endre.kovacs@uni-miskolc.hu	Physics and Electronic Engineering	The course is an introduction to the fundamental concepts, phenomena, models and laws of electrodynamics and modern physics, especially some basic elements of condensed matter physics. Based on these the students can understand the operation of the most important parts of the computer hardware, e.g. the CPU and the hard disk.
autumn	GEMTT080M-a	Polymer Processing	4	2	1	MSc	Dr. Péter Kovács	peter.kovacs@uni-miskolc.hu	Materials Science and Technology	Having mastered the basics of polymer processing, students are prepared to master computer-aided design of plastic forming tools, and can become involved in the work of plastic processing industry. They are discussing: The material properties of plastics, their special formability properties. A detailed discussion of the technological variants of plastics forming, taking into account the specific characteristics of plastics, affecting the basic designs of machine and tool solutions. The technology of injection molding will be analyzed in detail.
autumn	GEMAK629-Ma	Probability Theory & Mathematical Statis	5	2	2	MSc	Dr. József Túri	jozsef.turi@uni-miskolc.hu	Mathematics	To acquire knowledge in: - basic concepts of probability theory, including discrete and continuous random variables and their distributions, density functions, expectations, mean, and variance. - important specific discrete and continuous distributions. - basic sampling distribution theory and implications of the Central Limit Theorem. - how to develop mathematical problem-solving skills and to apply them to solve applied problems in probability. - various statistical topics, such as frequency distribution, elementary probability theory including discrete and continuous probability distributions, estimations, (parametric / non-parametric) hypothesis testing, and regression analysis. - how to solve practical chance-related problems in civil engineering areas through evaluation and selection of appropriate statistical techniques. - the use of some statistical softwares, such as Statistica for Windows, Matlab, to solve practical problems. - how to read and interpret computer-generated statistical outputs.
autumn	GEMAK131-B2a	Probability Theory and Mathematical Statistics	5	2	2	BSc	Dr. Sándor Fegyverneki	sandor.fegyverneki@uni-miskolc.hu	Mathematics	Concept of probability. Conditional probability. Independence of events. Random variables, distribution, cumulative distribution function, density function. Moivre-Laplace theorem. Law of large numbers. Conditional distribution and density function. Independent random variables. Distribution of minima and maxima. Central limit theorems. Sample space. Sample, sampling methods. Monte Carlo methods. Point estimations, unbiased estimations, efficiency, consistency, sufficiency. Rao-Cramer inequality. Rao-Blackwell.Kolmogorov-theorem. Interval estimations. Hypothesis testing, uniformly best tests. Parametric and non-parametric tests. Testing homogeneity and independence. Correlation and regression analysis.
both	GEGTT460-Ba	Production systems	4	2	1	BSc	Dr. György Kovács	gyorgy.kovacs@uni-miskolc.hu	Manufacturing Science	Global production tendencies. Changes in production philosophies and production processes. Characteristics and comparison of Push and Pull production concepts. Introduction of the Pull based production philosophies (JIT, Kanban, Lean). Characteristics and main activities of production systems and processes. General types and characteristics of intermittent and continuous production processes: project production, job-shop production, batch production, mass production and process production. Flexible manufacturing systems. Basic principles and main phases of production processes' design. Types and applications of industrial robots. Essence of Computer Integrated Manufacturing (CIM). Case studies.

spring	GEVAU518B-A	Programmable Logic	5	2	2	BSc	Dr. József Vásárhelyi	vajo@uni-miskolc.hu	Automation and Communication techn	Digital Circuit technologies and programmable logic technologies Characteristics of Programmable Logic devices (PLD), Application Specific Integrated Circuits (ASIC) ASIC versus PLD, Simple programmable Logic Devices (SPLD) Complex Programmable Logic Devices (CPLD) Field Programmable Gate Arrays (FPGA) architectures, Application of FPGA, System on Chip architectures, Hardware Description Languages. VHDL Verilog and High level synthesis. Open CL basics.
spring	GEIAL015B-A	Programming of Graphics	5	2	2	BSc	Dr. Péter Mileff	peter.mileff@uni-miskolc.hu	Information Science	The aim of the course is to understand methods algorithms behind real computer graphics applied in modern computer games. Todays most widely used 2D and 3D technologies (e.g. structure of the pipeline bounding box collision detection lightning and shadows etc) are presented. This integrated knowledge helps students to create graphics oriented applications and computer games.
autumn	GEIAL506M-a	Protection of Information Systems	4	2	2	MSc	György Wágner	gyorgy.wagner@uni-miskolc.hu	Information Science	Protection from physical damage, unauthorized access. Data loss; intruders; attack against security systems; advice from DEC; source of danger, risks, threats, costs; Confidentiality, integrity, availability, functionality. concept of protection, expand concept of protection; „Need to Know"; protection domain; Access Matrix and permissions; implementation of Access Matrix: Global Table, Access Control List, Capability List; Formal methods: Bell LaPadula, Biba; MAC, DAC; Firewalls; components of firewalls; Packet filtering firewall; Circuit level gateway; Application level gateway; stateless and stateful packet filtering firewall; High Availability firewalls; VPN; Deep Packet Inspection Firewall; TCSEC, ITSEC, Common Criteria; Attack methods: DoS, SYN flood, ICMP flood, OOB Nuke, sniffer, address spoofing, DDoS; steganography, cryptography; Kerckhoff; symmetric and asymmetric cryptography; problems of key share; solutions: Diffie-Hellman-Merkle, public key infrastructure; PGP, NTFS-EFS, digital signature and the Hash; the certificates; virus search methods.
spring	GEALT179-Ma	Quality Management of Logistics Systems	5	2	2	MSc	Dr. Bányainé Prof. Dr. Tóth	agota.banyaine@uni-miskolc.hu	Logistics	During the course, students will be introduced to the relationship between quality assurance and logistics, as well as the application of the basic methods and techniques used in quality assurance in logistics.
autumn	GEAHT013-Ba	Renewable Energy	4	2	1	BSc	Dr. Péter Bencs	peter.bencs@uni-miskolc.hu	Energy Engineering and Chemical Mach	Renewable energy basics, introduction. Sub-types of water turbines, small sample measurement. Sub-types of hydroelectric power plants. Energy diagram, pipeline blocking. Heat pump. Geothermal energy geothermal energy. Wind turbines operation, determining their performance. The theory of water decomposition. A basics of thermal radiation. Solar radiation theory of solar radiation, absolute black body, grey body radiation. The solar collector construction, application. Biomass.
both	GEIAK153B-a	Scheduling Models and Algorithms	4	2	2	BSc	Dr. Kulcsár Gyula	gyula.kulcsar@uni-miskolc.hu	Information Science	Introduction to scheduling. Classification of scheduling problems. Resource environments. Job characteristics and constraints. Objective functions. Single machine scheduling. Parallel machine scheduling. Flow shop, job shop, open shop, and general shop scheduling. Disjunctive graph model. Scheduling resources with limited availability in time. The role of simulation. Multi-objective optimization. Search metaheuristics. Resource-constrained project scheduling. Predictive, reactive, and proactive scheduling. Industrial scheduling case studies.
spring	GEIAL30B-B2a	Security in Computer Systems	5	2	2	BSc	Dr. György Wagner	gyorgy.wagner@uni-miskolc.hu	Information Science	Data; information; information security. Protection demand; sources of danger; classification of risk classes; defense costs. Protection of information; protection against physical injury; protection against unauthorized access; intrusions. Common identification methods; property-based identification; knowledge-based identification; biometric identifiers; strict identification; multifactor identification. Security policy; Firewalls; firewall building blocks: Packet filtering; stateful packet filtering; deep inspection firewall; circuit level gateway; proxy firewall. Security structures; VPN, Content filtering firewall; Web Application firewall; IPS and IDS systems; personal firewall. Virus scanners; antivirus engines; their operating principle; encrypted viruses; heuristic, resp. negative heuristic search.
spring	GEALT178-Ma	Simulation Examination of Logistics Systems	5	2	2	MSc	Prof. Dr. Péter Tamás	peter.tamas@uni-miskolc.hu	Logistics	During the course, students will be introduced to the possibilities of simulation modeling, evaluation and efficiency improvement of typical logistics systems. Using the knowledge gained, students will be able to model, evaluate, develop and design logistics processes with a simulation framework.
autumn	GEALT503-B2a	Simulation Modelling of Logistics Proces	5	2	2	BSc	Dr. Tamás Péter	peter.tamas@uni-miskolc.hu	Logistics	The course introduces the simulation modelling, evaluation and efficiency improvement capabilities of typical logistics systems. Using the knowledge gained, students will be able to model, evaluate, improve, and design logistics processes using a simulation framework.

autumn	GESGT006-Ma	Simulation of Manufacturing Devices	5	2	2	MSc	Dániel Kiss	daniel.kiss2@uni-miskolc.hu	Machine Tools and Mechatronics	Construction analysis of machine tools units. The finite element analysis of structures composed of these units: structural, thermal, and vibrational analysis of the cover plates of devices, vibration analysis of machine beds and the cutting process, balancing problems.
spring	GEIAL511-Ma	Software Engineering	5	2	2	MSc	Dr. Zoltán Krizsán	zoltan.krizsan@uni-miskolc.hu	Information Science	Software Engineering course gives a detailed insight into the modern software development methodologies and processes. Students gets understanding of cooperation of wide range of team work technologies. The student learn how to use the GIT, JIRA and Jenkins tool. The core technologies that are presented are source code management, project management, issue tracking, static code analysis and continuous integration. In addition to their bachelor studies, students acquire some team leading abilities that are indispensable for project managers or scrum masters.
spring	GEIAK647-Ma	Software System Security	4	2	2	MSc	Dr. Olivér Hornyák	oliver.hornyak@uni-miskolc.hu	Information Science	The aim of the course is to acquaint the student with the basic concepts of computer security, relevant standards, recommendations and good practices. In practical classes the goal is to help learners develop the habit of properly assessing and improving cyber risk posture in real computing, networking, and software systems.
autumn	GEIAL314-B2a	Software Technology	5	2	2	BSc	Dr. Péter Mileff	peter.mileff@uni-miskolc.hu	Information Science	Basic concepts of software engineering. Features of software as a product. The software development steps and life cycle models: waterautumn model, Evolutionary software development, Component-based software development, incremental (iterative) development approach. The spiral model. Process Activities. Presentation of Software requirements.Functional, non-functional requirements, user and system requirements, the requirements planning process. Exploration and analysis. The requirements document and feasibility study. Scenarios ethnography. Requirements Validation of Software Design. Architectural design, system build models. Modular decomposition, functioned piping, controlling types, object-oriented design. Unified Modelling Language (UML). Version controll systems, principles of user interface design.
spring	GEIAL316-B2a	Software Technology Lab	5	1	3	BSc	Dr. Tamás Tompa	tamas.tompa@uni-miskolc.hu	Information Science	The most important Java-based frameworks and their applications will be presented in addition to the Java programming language. Technologies and techniques covering the entire software life cycle will be introduced that the student is confident in a Java-based software development after completing the course. The course involves the followings: continuous integration, continuous development, software testing, software design patterns, version control systems, etc.
autumn	GEALT182-Ma	Standard Solutions in Logistics Networks	5	2	2	MSc	Prof. Dr. Péter Tamás	peter.tamas@uni-miskolc.hu	Logistics	During the course, students will be introduced to the standard processes of supply chain identification, data collection, and data sharing. The process activities and their measurement techniques, that mainly occur in logistics, play a major role in the course. The course also aims to familiarize students with the practical uses of sector-independent standards and solutions developed to make business communication and supply chain processes more efficient.
spring	GEMET001-B2a	Statics	5	2	2	BSc	Dr. Balázs Tóth	balazs.toth@uni-miskolc.hu	Mechanics	Introduction to engineering mechanics. Fundamental concepts and models in mechanics. Equi-librium of a particle. Moment of a force about a point and an axis. Three-dimensional force sys-tems acting on a rigid body. Resultants of a force and couple system. Equivalent and equilibrat-ed systems of forces. The main theorem of statics. The Coulomb-model of dry friction. Supports for rigid bodies. Equilibrium of a rigid body. The free-body diagram. Distributed loading and its resultant. Center of gravity, center of mass and the centroid. Equilibrium of structures. Plane and space trusses. The method of joints and the method of sections. Internal forces and mo-ments in structural members. Bars and beams. Equations of equilibrium for internal forces and moments. Axial force, shear force and bending moment diagrams. Cables.
autumn	GEMTT001-B2a	Structural Materials I.	5	2	2	BSc	Dr. Marcell Gáspár	marcell.gaspar@uni-miskolc.hu	Materials Science and Technology	Classification of materials used in engineering practice and their production technologies. Structural overview of material properties and behaviour. Test methods for mechanical proper-ties (Uniaxial tension test and Hardening test). Basic crystallography - Ideal, realistic crystal lat-tice. Laws of crystallization. Crystallization of non-ferrous metals. Theoretical basis of properties of single-phase metallic materials. Alloys, equilibrium diagrams of two-constituent systems. Henry-Charpy twin diagram of iron-carbon alloy system. Analysis of crystallization of typical iron-carbon alloys. Bending, compression, impact tests. Mechanical properties and fabric struc-ture of non-alloy steels.

spring	GEMTT002-B2a	Structural Materials II.	5	2	2	BSc	Dr. Marcell Gáspár	marcell.gaspar@uni-miskolc.hu	Materials Science and Technology	The aim of the course is to develop students' knowledge of structural materials. The object of the course is to familiarise students with the typical properties, potential damage, and applications of the most important groups of materials. During the semester, the following topics are covered in detail: the effect of temperature on the structure and properties of steels. Classification and designation of steels. Structural steels. Tool steels. Non-ferrous and light alloys. Typical loads on and damage to metallic materials. Defect detection tests. Technical ceramics. Engineering poly-mers. Composites, foams.
spring	GEGET335-Ma	System Engineering and System Modeling	5	2	2	MSc	Prof. Dr. Gabriella Vadászn	gabriella.v.bognar@uni-miskolc.hu		Modeling of the elements of mechanical systems and their relation system, recognition of the internal laws of the systems, mathematical description. Getting to know the basic elements of modeling, the general conditions of application, taking into account its limitations.
autumn	GEIAK100-B2a	Technical Communication	5	2	2	BSc	Dr. Károly Nehéz	karoly.nehez@uni-miskolc.hu	Information Science	Students will learn about basics of logic, numerical systems, basics systems theory, description of information, coding, encryption and semantics, model modelling and fundamentals of computer aided modelling.
autumn	GEIAK691-Ma	Technical English	5	2	2	MSc	Dr. Samad Dadvandipour	samad.dadvandipour@uni-miskolc.hu	Information Science	The subject covers a wide range of lessons on “Classic literature in Technical Science” and “Information Science & Technology” using texts and materials taken from textbooks, newspapers, computer magazines and websites. Classic literature in Technical Science mainly focuses on the comprehensive learning of materials needed to set up students’ language skills and ability in classic engineering sciences. The lessons are based on those materials which taken from different textbooks, they include material science, solid mechanics, fluid mechanics, electric, electronic & computer science, oil industry, energy and innovative engineering sciences. The covering topics of Information Science and Technology involve principles on computer architecture, computer application, operating system, application programs, networks, communication systems, and IT (recent and future developments). The main aim of the subject is to provide students’ ability in expanding their knowledge in R&D (Research and Development) using the English language.
spring	GEALT500-B2a	Technical Logistics	6	3	2	BSc	Dr. Péter Tamás	peter.tamas@uni-miskolc.hu	Logistics	During the course, the students are introduced to the professional knowledge of logistics; to show the development of logistics and its relationship with material handling; determine the professional content of logistics; to develop the technical-logistics approach; explore the relational system of material and information flow; describe the main technical and IT equipment belonging to the operation of the logistics system.
spring	GEMAN533-Ma	Theory of Error-Correcting Codes	5	2	2	MSc	Dr. Csaba Rakaczki	csaba.rakaczki@uni-miskolc.hu	Information Science	Coding theory is concerned with successfully transmitting data through a noisy channel and correcting errors in corrupted messages. The aim of the course is to familiarize students with the theory of errorcorrecting codes. The course covers the simpler families of codes such as linear, Hamming, Reed-Solomon, cyclic, BCH codes with encoding and decoding methods
both	GEMAK137-Ba	Time series analysis and its applications	5	2	2	BSc	Dr. József Túri	jozsef.turi@uni-miskolc.hu	Mathematics	Different time series will be presented during the course. We show what time series we can use to model different phenomena. During the course, we solve the modeling of many technical phenomena with the help of time series.
spring	GEALT506-B2a	Transportation Systems	6	3	2	BSc	Dr. Róbert Skapinyecz	robert.skapinyecz@uni-miskolc.hu	Logistics	Characterization and development of transport systems, transport system connections. Transport sectors, transport technical systems, transport lanes, vehicles, energy supply, drive systems, transport service facilities. Trans-European networks (TEN) and pan-European corridors. Rail, road, water, air and combined transport. Environmental effects of transport, environmental impact, sustainability aspects. Evaluation and qualification of transport services, service quality assurance. Transport strategies, National Transport Strategy, EU Mobility Strategy. Introduction to the basics of traffic simulation software.
autumn	GEVGT003B-a	Unit Operation I.	4	2	2	BSc	Dr. Zoltán Szamosi	zoltan.szamosi@uni-miskolc.hu	Energy Engineering and Chemical Mach	Definitions and principles dimension analysis hydrostatics hydro dynamics flow of compressible and incompressible fluids transporting of fluids pumps pipes valves block flow diagrams process flow diagrams and P and ID hidrodynamical and mechanical unit operation heat transfer and its equipments mass transfer equipments of the mass transfer
spring	GEGET073-B2a	Vehicle Components	5	2	2	BSc	Dr. Károly Jálics	karoly.jalics@uni-miskolc.hu	Machine and Product Design	The aim of the subject is to wide the horizons of the students. The subject is used for individual logistical purposes, or describes the basic characteristics of usable vehicles and the tracks and roads they use, with increased emphasis placed on independent work and continuous discussion of topics.