Course descriptions

Course: **Probability Theory & Mathematical Statistics**	**Credits: 3**

Labelling of course: **required**

Rate of practical or theoretical content: 60-40 (kredit%)

Class type: lect. + pract., no. of classes/term: 28+14,
(*language*: *English)*
Any other ways of knowledge dissemination *(if applied)*: -

Assessment (exam. / term-mark / **any other**): exam
Any other ways of assessment *(if applied)*: -

Frequency of course: **1. semester**

Prerequisites:

The brief description of the course:

Course Objectives:
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.

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1.) V.K. Rohatgi, A.K. Saleh: An introduction to probability theory and statistics, Wiley, New York, 2001.
2.) R. Bhattacharya, E.C. Waymire: A Basic Course in Probability Theory, Springer, New York, 2007.
3.) A.O. Allen: Probability, Statistics and Queueing Theory, Academic Press, Boston, 1990.
4.) T.T. Soong: Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons Ltd, 2004.

5.) Sheldon M. Ross: Introduction to Probability and Statistics for Engineers and Scientists, Elsevier Inc., 2004.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering.
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation.

b) skills
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering.
- Ability to enrich the knowledge base of mechanical engineering with original ideas.

c) attitude
- Commitment to professional and ethical values related to engineering.

d) autonomy and responsibility
- Ability to perform engineering tasks individually.

Course coordinator (*name, position, sci. degree*)**: Dr. habil Kwami Nutefe AGBEKO, associate professor, PhD.**

Teachers involved (*name, position, sci. degree*)**: -**

Course: **Modern Physics**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 100-0% (credit%)	
Class type: lect., no. of classes/term: 28, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **1. semester**	
Prerequisites:	

The brief description of the course:

The special theory of relativity and Lorentz-transformation. The basic concepts of relativistic dynamics, mass-energy equivalence. Experimental basics of quantum mechanics. Black-body radiation. Specific heat of solid objects. Photoelectric effect, the concept of photon. Compton effect. Radioactivity, alpha beta and gamma decay. The measurement of radioactive decay. Emission spectrum of gases. Bohr-model of hydrogen atom. De-Broglie hypothesis, wave-particle duality. Electron interference experiment. Heisenberg uncertainty principle. Schrödinger equation of quantum mechanics. Tunnel-effect and applications. X-rays. Quantum optics, the theory of lasers. Nuclear interaction, binding energy. The operation of nuclear power plants.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Halliday and Resnic: Fundamentals of Physics, John Wiley & Sons, 1981.
2. Alonso and Finn: Fundamental University Physics III, Addison-Wesley Pub., 1968.
3. Sears Zemansky and Young: College Physics, Addison-Wesley Pub., 1980.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering.

b) skills
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering.

c) attitude
-

d) autonomy and responsibility
-

Course coordinator (*name, position, sci. degree*)**: Dr Béla Palásthy associate professor, PhD**

Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Mechanical Vibrations**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **1. semester**	
Prerequisites:	

The brief description of the course:

Principles of modelling dynamical systems. Central and eccentric impact of rigid bodies, the Maxwell-diagram. 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 free- and 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 multi-cylinder 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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Geradin, M. – Rixen, D.: *Mechanical Vibrations, Theory and Application to Structural Dynamics*, Blackwell Publishers, Wiley, 2010. ISBN 0-470-84786-7
2. Meirovitch, L.: *Fundamentals of Vibrations*, McGraw-Hill, New York, 2001. ISBN 0-072-88180-1
3. Weawer, W. – Timoshenko, S.P. – Young, D.H.: *Vibration Problems in Engineering*, Wiley, New York, 1990. ISBN 0-471-63228-7
4. Gy. Szeidl – L. Kiss.: *Mechanical Vibrations* (unpublished manuscript of the lecture notes given freely to the students, 212 p.)

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering.
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field.
- Knowledge and understanding of devices and methods of computer modelling and simulation related to mechanical engineering.

b) skills

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering.
- Ability to solve problems using engineering theories and related terminology in an innovative way.
- Ability to enrich the knowledge base of mechanical engineering with original ideas.
- Ability to solve problems in a creative, and complex tasks in a flexible way, as well as to pursue life-long learning and to demonstrate a commitment to diversity and value-basedness.

c) attitude

- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering.
- Striving to continuously improve their own and their colleagues' knowledge through further and self-education.
- Striving to acquire a comprehensive knowledge.
- Participation in mechanical engineering R&D projects, applying theoretical and practical knowledge and skills in collaboration with members of the development team.

d) autonomy and responsibility

- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways.
- Ability to perform engineering tasks individually.
- Initiative to solve engineering problems.
- Acting independently and initiatively to solve professional problems.

Course coordinator (*name, position, sci. degree*)**: Dr. Edgár Bertóti, professor, DSc**

Teachers involved in course (*name, position, sci. degree*)**:**

László Péter Kiss, senior lecturer, PhD

Course: **Industrial Quality Assurance**	**Credits: 4**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: -	
Frequency of course: **1. semester**	
Prerequisites:	

The brief description of the course:

The importance of quality in the process of product production, transportation, usage, etc. Measurability of quality, types of parameters determining of quality (quality parameters). Tasks of planning, developing and assurance of quality: analysing of information, formation of product concept, production planning, feasibility analysis, assuring of sources (machine, tool, technology, human researches), planning of inspection technology. Quality assurance of purchasing, choosing and qualification of deliverers. Quality assurance of production processes. Quality assurance, quality protection in the process of transportation, storage, and packaging. Methods and instruments for helping quality assurance.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Compulsory books:

1. Godfrey, A. B.; Juran, J. M.: *Juran's Quality Handbook,*, ISBN 007034003X, 1999
2. Hartman, M. G. (editor): *Fundamental Concepts of Quality Improvement*, ISBN 0873895258, 2002

Recommended reading:

1. Ott, E. R., Schilling, E. G. and Neubauer, D. V.: *Process Quality Control: Troubleshooting and Interpretation of Data*, Fourth Edition, ISBN 978-0-87389-655-9, 2005
2. Stamatis, D. H.: Failure Mode and Effect Analysis: FMEA From Theory to Execution, Second Edition, ISBN 978-0-87389-598-9, 2003

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Comprehensive understanding of global social and economic processes.
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation.
- Knowledge of measurement techniques and theory related to mechanical engineering.

b) skills
- Ability to solve problems using engineering theories and related terminology in an innovative way.
- Ability to study and analyse the materials used in mechanical engineering in a laboratory, as well as to assess and document research results.

c) attitude
- Striving to design and perform tasks individually or in a team at a professionally high level.
- Commitment to enrich the field of mechanical engineering with new findings and scientific results.

d) autonomy and responsibility

- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways.
- Ability to perform engineering tasks individually.

Course coordinator (*name, position, sci. degree*)**: Dr. Gyula Varga associate professor, PhD**

Teachers involved in course (*name, position, sci. degree*)**:**

Renáta Hörcsik, Monostoriné, assistant lecturer

Course: Computer Aided Process Planning	**Credits: 3**

Labelling of course: **required**

Rate of practical or theoretical content: 60-40 (credit%)

Class type: lect. + pract., no. of classes/term: 28+14,
(*language*: *English)*
Any other ways of knowledge dissemination *(if applied)*: -

Assessment (exam. / term-mark / **any other**): exam
Any other ways of assessment *(if applied)*: -

Frequency of course: **1. semester**

Prerequisites:

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Tisza, M.: *Metal Forming*, University Publisher, University of Miskolc, Miskolc, 2004. p. 1-316.
2. Zeid, I.: *CAD/CAM Theory and Practice*, Mc Graw Hill, Inc. New York, 1991. p. 1-1052.
3. Groover, M., Zimmers, E.: *Computer Aided Design and Manufacturing*, Prentice Hall Inc., New Jersey, 1994. p. 1-489

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation

b) skills
- Ability to apply information and communication technologies and methods to solve engineering problems
Ability to study and analyse the materials used in mechanical engineering in a laboratory, as well as to assess and document research results

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering

d) autonomy and responsibility
- Ability to perform engineering tasks individually

Course coordinator (*name, position, sci. degree*)**: Dr. Zsolt Lukács, associate professor, PhD.**

Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Advanced Materials Processing**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: -	
Frequency of course: **1. semester**	
Prerequisites:	

The brief description of the course:

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 density 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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. ASM Handbook, Vol. 4 Heat Treating (ISBN 0-87170-379-3)
2. ASM Handbook, Vol. 6 Welding, Brazing and Soldering (ISBN 0-87170-377-7)
3. ASM Handbook, Vol. 7 Powder Metal Technologies (ISBN 0-87170-387-4)
4. ASM Handbook, Vol. 14 Forming and Forging (ISBN 0-87170-007-7)
5. ASM Handbook, Vol. 15 Casting (ISBN 0-87170-007-7)

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation
- Broad theoretical and practical background as well as methodological and practical knowledge of design, manufacture, operation and control of complex mechanical systems and processes

b) skills
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way
- Ability to process, systemise and analyse information gained through the operation of mechanical systems and processes, as well as to draw conclusions
- Ability to apply integrated knowledge from the field of machines, mechanical engineering devices, systems and processes, engineering materials and technologies, as well as related electronics and informatics

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering

- Striving to understand, describe and explain observable phenomena as thoroughly as possible applying the engineering knowledge acquired

d) autonomy and responsibility

- Ability to perform engineering tasks individually

Course coordinator (*name, position, sci. degree*)**: Dr. Marcell Gyula Gáspár, senior lecturer, PhD**

Teachers involved in course (*name, position, sci. degree*)**:**

Raghawendra P. S. Sisodia, assistant research fellow

Course: **Automated Machine Tools**	**Credits: 3**

Labelling of course: **required**

Rate of practical or theoretical content: 66-33 (credit%)

Class type: lect. + pract., no. of classes/term: 28+14,
(*language*: *English)*
Any other ways of knowledge dissemination *(if applied)*: -

Assessment (exam. / term-mark / **any other**): exam
Any other ways of assessment *(if applied)*: -

Frequency of course: **1. semester**

Prerequisites:

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Calrence W. de Silva: Mechatronics An Integrated Approach CRC Press LLC 2005 ISBN 0-8493-1274-4
2. López de Lecalle, L. N. et al.: Machine Tools for High Performance Machining. Springer-Verlag London Limited 2009
3. Sotiris L. Omirou: Space Curve Interpolation for CNC Machines. Journal of Materials Processing Technology 141 (2003) 343-350

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field.
- A comprehensive understanding of the methods used in machine, system and process design in the field of mechanical engineering.

b) skills
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way.
- Ability to process, systemise and analyse information gained through the operation of mechanical systems and processes, as well as to draw conclusions.

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering
- Striving to perform work in a complex, system based and process oriented way.

d) autonomy and responsibility
- Ability to perform engineering tasks individually
- Acting independently and initiatively to solve professional problems.

Course coordinator (*name, position, sci. degree*)**: Dr. György Hegedűs, associate professor, PhD.**

Teachers involved in course (*name, position, sci. degree*)**: Dr. Tibor Csáki, honorary professor, CSc**

Course: **iCAD Systems I**	**Credits: 4**
Labelling of course: **required**	
Rate of practical or theoretical content: 55-45 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **1. semester**	
Prerequisites:	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

J. Duhovnik, I. Demsar, P. Drešar, Space Modeling with SolidWorks and NX, Springer International Publishing, 2014, ISBN 978-3-31903-862-9
Max K. Agoston: Computer graphics and geometric modeling, Implementation and algorithms, Springer, 2005, ISBN 1-85233-818-0
Christoph M. Hoffmann: Geometric and solid modeling, Morgan Kaufmann, 1989, ISBN 1-55860-067-1
Ian Stroud, Hildegarde Nagy: Solid modelling and CAD systems, How to survive a CAD system, Springer, 2011, ISBN 978-0-85729-259-9
Gerald Farin: Curves and Surfaces for CAGD, A Practical Guide, Morgan Kauffmann, 2001, ISBN: 978-1-55860-737-8

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge and understanding of devices and methods of computer modelling and simulation related to mechanical engineering

b) skills
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to solve specific engineering problems by applying modern knowledge acquisition and data collection methods

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering
- Striving to design and perform tasks individually or in a team at a professionally high level

d) autonomy and responsibility
- Ability to perform engineering tasks individually
- Acting independently and initiatively to solve professional problems

Course coordinator (*name, position, sci. degree*)**: Dr. György Hegedűs, associate professor, PhD**
Teachers involved in course (*name, position, sci. degree*)**:-**

Course: Differential Equations	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 70-30 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: **-**	
Frequency of course: **2. semester**	
Prerequisites:	

The brief description of the course:

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.

Paul Dawkins: Differential Equations (free textbook, http://tutorial.math.lamar.edu/Classes/DE/DE.aspx)
MIT OCW: Honors Differential Equation 18.034
http://mit.ocw.edu/courses/mathematics

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge:

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering.

b) skills:

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering.
- Ability to solve problems using engineering theories and related terminology in an innovative way.

c) attitude:

- Striving to acquire a comprehensive knowledge.
- Striving to perform work in a complex, system based and process oriented way.
- Commitment to do high-level, high quality work, setting an example to co-workers of how to adopt this attitude.

d) autonomy and responsibility:

- Acting independently and initiatively to solve professional problems.

Course coordinator (*name, position, sci. degree*)**: Dr. Péter Varga, associate professor, PhD.**

Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Theory of Elasticity**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **2. semester**	
Prerequisites:	

The brief description of the course:

A short introduction to tensor algebra and analysis in indicial notations using Cartesian coordinate systems. Elements of the nonlinear theory of deformations: strain tensors in the initial and current configurations. Theory of stresses – Cauchy and Piola-Kirchhoff stress tensors. Equations of motion for solid bodies. The first theorem of thermodynamics and the fundamental form of the constitutive equations. Governing equations of the linear theory of elasticity (strain-displacement relations, generalized Hooke's law, equations of equilibrium). Boundary and initial conditions. Formulation of boundary value problems in elasticity. The Lamè-Navier equation. Compatibility equations. Principles of superposition, Clapeyron's theorem. Reciprocity relations, Betti's theorem. Energy methods. Principle of virtual work and principle of complementary virtual work. Uniqueness of solution. Principles of minimum potential and complementary energy. Rayleigh-Ritz method. Torsion (general solutions, membrane analogy, thin-walled open- and closed cross-sections). Equations in polar coordinates. Plane stress, plane strain and axisymmetric problems. Stresses in circular disks and rotating shafts.

The subject covers the fundamental principles and methods of elasticity and helps in making correct decisions in the process of engineering modelling and finite element simulations of different problems in mechanical engineering.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Asaro, R.J. – Lubarda, V.A.: *Mechanics of Solids and Materials*, Cambridge University Press, New York, 2006, ISBN 0-521-85979-4
2. Chou, P.C. – Pagano, N.J.: *Elasticity. Tensor, Dyadic, and Engineering Approaches*, Dover, New York, 1992. ISBN 0-486-66958-0
3. Slaughter, W.S.: *The Linearized Theory of Elasticity*, Birkhäuser, Boston, 2002. ISBN 0-817-64117-3
4. Armenàkas, A.E.: *Advanced Mechanics of Materials & Applied Elasticity*, Taylor and Francis, New York, 2006. ISBN 0-849-39899-1
5. Gy. Szeidl – L. Kiss.: *Theory of Elasticity – an introduction* (unpublished manuscript of the lecture notes given freely to the students, 215 p.)

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field

- Knowledge and understanding of devices and methods of computer modelling and simulation related to mechanical engineering

b) skills

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to enrich the knowledge base of mechanical engineering with original ideas
- Ability to solve problems in a creative, and complex tasks in a flexible way, as well as to pursue life-long learning and to demonstrate a commitment to diversity and value-basedness

c) attitude

- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering
- Striving to acquire a comprehensive knowledge
- Striving to understand, describe and explain observable phenomena as thoroughly as possible applying the engineering knowledge acquired
- Commitment to enrich the field of mechanical engineering with new findings and scientific results

d) autonomy and responsibility

- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways
- Making professional decisions individually within the field
- Acting independently and initiatively to solve professional problems

Course coordinator (*name, position, sci. degree*)**: Dr. Edgár Bertóti, professor, DSc**

Teachers involved in course (*name, position, sci. degree*)**:**

Dr. László Péter Kiss, senior lecturer, PhD

Course: **Materials Science**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **2. semester**	
Prerequisites:	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. William D. Callister: *Materials Science and Engineering*, John Wiely & Sons, New York, 2004. p. 1-808.
2. Porter, D.A., Easterling, K.E. Phase Transformation in Metals and Alloys,Chapman & Hall, 1981, ISBN 0 412 45030 5
3. Ashby, M.F, Jones, D.R.H.: Engineering Materials 1-An introduction to Microstructures, Processing and Design 3rd ed., Elsevier Butterwoth-heinemann, Oxford, 2006. ISBN 0 7506 63804
4. Ashby, M.F, Jones, D.R.H.: Engineering Materials 2-An introduction to properties, Applications and Design 3rd ed., Elsevier Butterwoth-heinemann, Oxford, 2006. ISBN-13: 978-0-7506-6381-6

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge

- Knowledge of fundamental theories, relations, and the terminology used in the engineering field
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation;
- A comprehensive understanding of the main properties and application fields of structural materials related to mechanical engineering

b) skills

- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to publish research work, make presentations and hold discussions in their field in their mother tongue and at least in one foreign language

– Ability to apply integrated knowledge from the field of machines, mechanical engineering devices, systems and processes, engineering materials and technologies, as well as related electronics and informatics

c) attitude

– Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering
– Striving to enforce the requirements of sustainability and energy efficiency
– Striving to understand, describe and explain observable phenomena as thoroughly as possible applying the engineering knowledge acquired

d) autonomy and responsibility

– Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways
– Ability to perform engineering tasks individually
– Responsibility for sustainability, health and safety culture at work, as well as environmental consciousness

Course coordinator (*name, position, sci. degree*)**: Dr. Mária Berkes, Marosné, associate professor, PhD**

Teachers involved in course (*name, position, sci. degree*)**:**

Dr. Andrea Biró, Szilágyiné, associate professor, PhD.

Course: **Engineering Fluid Mechanics and Heat Transfer**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 50-50 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **2. semester**	
Prerequisites:	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Compulsory reading

1. White, F.M.: *Fluid Mechanics.* 4th Edition, McGraw-Hill, Boston, 1999.
2. Özisik, M.N.: *Heat Transfer*. 3rd Edition, McGraw-Hill, New York, 1985.

Suggested reading:

1. Roberson, J.A. - Crowe, C.T.: *Engineering Fluid Mechanics.* 3rd Edition, Houghton Mifflin Company, Boston, 1985.
2. Bejan, A.: *Heat Transfer.* John Wiley and Sons, New York, 1993.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field

b) skills

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering,
- Ability to solve problems using engineering theories and related terminology in an innovative way,
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way.

c) attitude

- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering,

- Striving to participate in the development of new methods and equipment related to engineering. A deep sense of vocation,
- Striving to continuously improve their own and their colleagues' knowledge through further and self-education,
- Striving to enforce the requirements of sustainability and energy efficiency,
- Commitment to enrich the field of mechanical engineering with new findings and scientific results.

d) autonomy and responsibility

- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways,
- Assessing subordinates' work, sharing critical comments to improve their professional development,
- Ability to perform engineering tasks individually,
- Initiative to solve engineering problems,
- Making professional decisions individually within the field,
- Acting independently and initiatively to solve professional problems,

Course coordinator (*name, position, sci. degree*)**: Dr. László Baranyi,** professor, CSc

Teachers involved in course (*name, position, sci. degree*)**:**
Norbert Szaszák assistant lecturer

Course: **Environmental Management**	**Credits: 3**

Labelling of course:: **obligatory**

Rate of practical or theoretical content: 40-60 (credit%)

Class type: lect., no. of classes/term: 28,(*language*: *English)*
Any other ways of knowledge dissemination *(if applied)*: -

Assessment (exam. / term-mark / **any other**): term mark
Any other ways of assessment *(if applied)*: -

Frequency of course: **2. semester**

Prerequisites:

The brief description of the course:

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 CO_2 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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

[1] Richard S. Stein, Joseph Power: Energy problem, World Scientific, USA 2011
[2] David J Mackay: Sustainable energy without hot air, Cambridge, 2008
John Blewitt: Understanding Sustainable Development, Earthscan, 2008

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- A detailed knowledge and understanding of mechanisms of knowledge acquisition and methods for data collection, their ethical barriers and problem-solving techniques related to the engineering field

b) skills
- Ability to organise cooperation with experts from related fields to solve problems
- Ability to design and manage the use of technical, economic, environmental and human resources in a complex way.

c) attitude
- Striving to enforce the requirements of sustainability and energy efficiency.
- Commitment to health and safety culture as well as health improvement.

d) autonomy and responsibility
- Responsibility for sustainability, health and safety culture at work, as well as environmental consciousness.
- Making informed decisions individually after consultations with representatives from diverse fields (primarily that of law, economics, energy management, environmental protection), taking responsibility for the decisision.
- Make decisions based on principles and applicability of environmental protection, quality assurance, consumer protection, product responsibility, equal rights to accessibility, as well as the basic principles of occupational health and safety, technological, economic and legal regulations, moreover basic requirements of engineering ethics

Course coordinator (*name, position, sci. degree*)**: Dr. Zoltán Szamosi,** senior lecturer, PhD

Course: **Machine Structures and Design**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 50% (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **2. semester**	
Prerequisites:	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Budynas, R. – Nisbett, K.: Shigley's Mechanical Engineering Design. 8th edition. McGraw−Hill Primis, 2006. p. 260 – 348, p. 762 – 801. ISBN: 0−390−76487−6.
2. Hamrock, B. J. – Jacobson, B – Schmid, S. R.: Fundamentals of machine elements. WBC/McGraw-Hill, 1999. p. 257 – 306. ISBN 0-256-19069-0.
3. Juvinall, R. C. – Marschek, K. M.: Fundamentals of machine component design. 3rd edition. John Wiley & Sons, 2000. p. 301 – 353, p. 692 – 724. ISBN 0-471-24448-1.
4. Norton, R. L.: Machine Design. 3rd edition. Pearson Prentice Hall, 2006. p. 299-414, p. 714-738. ISBN 0-13-148190-8.
5. Stephens, R. I. – Fatemi, A. – Stephens, R. R. – Fuchs, H. O.: Metal fatigue in engineering. 2nd edition. John Wiley & Sons, 2001. ISBN 0-471-51059-9.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- A detailed knowledge and understanding of mechanisms of knowledge acquisition and methods for data collection, their ethical barriers and problem-solving techniques related to the engineering field

b) skills
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to apply information and communication technologies and methods to solve engineering problems
- Ability to enrich the knowledge base of mechanical engineering with original ideas

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering,

- Examining the possibilities of setting research, development and innovation objectives and striving to achieve them during their work

d) autonomy and responsibility

- Ability to perform engineering tasks individually

Course coordinator (*name, position, sci. degree*)**: Dr. Ágnes Judit Takács associate professor, PhD**
Teachers involved in course (*name, position, sci. degree*)**: Géza Németh senior lecturer**

Course: **Manufacturing Processes and Systems**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **2. semester**	
Prerequisites:	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. George Chryssolouris: Manufacturing Systems: Theory and Practice, 2nd Edition, Springer (USA), 2006, ISBN 0-387-25683-0,
2. Myer Kutz: Mechanical Engineer's Handbook Volume 3: Manufacturing and Management. John Wiley & Sons (USA), 2006, ISBN-13: 978-0-471-44990-4, ISBN-10: 0-471-44990-3
3. Mikell G.Groover: Fundamentals of Modern Manufacturing: Materials, Processes and Systems, John Wiley & Sons (USA), 2007, ISBN-13: 978-0-471-74485-6, ISBN-10: 0-471-74485-9

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Comprehensive understanding of global social and economic processes
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation.,
- Broad theoretical and practical background as well as methodological and practical knowledge of design, manufacture, operation and control of complex mechanical systems and processes.

b) skills
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to apply integrated knowledge from the field of machines, mechanical engineering devices, systems and processes, engineering materials and technologies, as well as related electronics and informatics.

c) attitude
- Striving to design and perform tasks individually or in a team at a professionally high level,
- Participation in mechanical engineering R&D projects, applying theoretical and practical knowledge and skills in collaboration with members of the development team

d) autonomy and responsibility

- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways,
- Ability to perform engineering tasks individually

Course coordinator (*name, position, sci. degree*)**: Dr. Csaba Felhő, associate professor, PhD**
Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Measurement, Signal Processing and Electronics**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 50-50 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: -	
Frequency of course: **2. semester**	
Prerequisites:	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Tietze, U., Schenk, Electronic Circuits --- Handbook for Design and Applications, 2008
J. G. Webster: Electrical Measurement, Signal processing and Displays, 2004
E. O. Doeblin: Measurement systems, McGraw-Hill International Editions, 1990.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field,
- Knowledge of measurement techniques and theory related to mechanical engineering

b) skills
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way
- Ability to enrich the knowledge base of mechanical engineering with original ideas
- Ability to provide quality assurance for mechanical systems, technologies and processes, and to solve tasks of measurement technique and process control

c) attitude
- Striving to participate in the development of new methods and equipment related to engineering. A deep sense of vocation
- Striving to perform work in a complex, system based and process oriented way

d) autonomy and responsibility
- Ability to perform engineering tasks individually
- Acting independently and initiatively to solve professional problems

Course coordinator (*name, position, sci. degree*)**: Dr. Lajos Tibor Tóth, associate professor, PhD**

Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **ICAD System II.**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **2. semester**	
Prerequisites: **ICAD System I**	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Tisza, M.: *Metal Forming*, University Publisher, University of Miskolc, Miskolc, 2004. p. 1-316.
2. Zeid, I.: *CAD/CAM Theory and Practice*, Mc Graw Hill, Inc. New York, 1991. p. 1-1052.
3. Groover, M., Zimmers, E.: *Computer Aided Design and Manufacturing*, Prentice Hall Inc., New Jersey, 1994. p. 1-489

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation

b) skills
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to apply information and communication technologies and methods to solve engineering problems
- Ability to study and analyse the materials used in mechanical engineering in a laboratory, as well as to assess and document research results

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering

d) autonomy and responsibility
- Ability to perform engineering tasks individually.

Course coordinator (*name, position, sci. degree*)**: Dr. Zsolt Lukács, associate professor, PhD.**
Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Methodical Design**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 55-45 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: -	
Frequency of course: **2. semester**	
Prerequisites: **ICAD System I**	

The brief description of the course:

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 production-correct design, DFM(x) requirements. Reverse-engineering design technique. Rapid-prototyping technologies. Rapid tooling technologies. Safety in design (ISO standards).

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

N. Cross, Engineering Design Methods - Strategies for Product Design (Third Edition), London: John Wiley 2005, ISB 978-0-47187-250-4.
G. Pahl, W. Beitz, J. Feldhusen and Karl-Heinrich Grote, Engineering Design - A Systematic Approach, London: Springer-Verlag 2007, ISBN 978-1-84628-318-5.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation

b) skills
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to solve specific engineering problems by applying modern knowledge acquisition and data collection methods

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering
- Examining the possibilities of setting research, development and innovation objectives and striving to achieve them during their work

d) autonomy and responsibility

- Ability to perform engineering tasks individually
- - Acting independently and initiatively to solve professional problems

Course coordinator (*name, position, sci. degree*)**: Dr. György Hegedűs, associate professor, PhD**
Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Materials Handling Machines and Systems**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **3. semester**	
Prerequisites:	

The brief description of the course:

Definition of material handling, objectives of material handling. Classification of materials handling equipment. Cranes. Trucks. Conveyors. Storage and warehousing. Basic storage equipment. The unit load concept. Productivity ratios and material handling. Basic facility location problems: single and multi-facility placement problems. Location analysis. Route planning methods. Equipment selection, flow lines and packaging. Simulation of material handling systems. Robotised material handling.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

R.A. Kulwiec: Materials handling handbook. J. Wiley and Sons, 1985.
M. P. Stephens, F. E. Meyers: Manufacturing Facilities Design and Material Handling, Pearson, 2010.
J. M. Apple: Material handling system design, J. Wiley and Sons, 1977.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation
- Knowledge and understanding of terminology, main regulations and aspects of other areas relating to and having a priority for practising engineering (primarily that of logistics, management, environmental protection, quality assurance, information technology, law, economics, occupational and fire safety, industrial safety)
- Broad theoretical and practical background as well as methodological and practical knowledge of design, manufacture, operation and control of complex mechanical systems and processes

b) skills

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way
- Ability to publish research work, make presentations and hold discussions in their field in their mother tongue and at least in one foreign language
- Ability to design complex systems using a system approach and process oriented way of thinking

c) attitude

- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering
- Striving to perform work in a complex, system based and process oriented way
- Commitment to enrich the field of mechanical engineering with new findings and scientific results

d) autonomy and responsibility

- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways
- Ability to perform engineering tasks individually
- Initiative to solve engineering problems
- Acting independently and initiatively to solve professional problems

Course coordinator (*name, position, sci. degree*)**: Dr. Tamás Bányai**, associate professor, PhD

Teachers involved in course (*name, position, sci. degree*)**:**

Dr. Péter Telek, associate professor, PhD

Course: **Simulation of Manufacturing Devices**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 66-33 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **3. semester**	
Prerequisites:	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Harris and Creede.: Shock & Vibration Handbook, McGraw – Hill Book Co., Inc. 1961.;
Den Hartogh, J.P.: Mechanical Vibrations, McGraw – Hill Book Co., Inc. 1956.;
Den Hartogh, J.P.: Advanced strength of materials, Dover Publications, 1987.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field
- Broad theoretical and practical background as well as methodological and practical knowledge of design, manufacture, operation and control of complex mechanical systems and processes

b) skills
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way
- Ability to study and analyse the materials used in mechanical engineering in a laboratory, as well as to assess and document research results
- Ability to process, systemise and analyse information gained through the operation of mechanical systems and processes, as well as to draw conclusions

c) attitude
- Striving to participate in the development of new methods and equipment related to engineering. A deep sense of vocation
- Striving to acquire a comprehensive knowledge
- Striving to design and perform tasks individually or in a team at a professionally high level
- Commitment to enrich the field of mechanical engineering with new findings and scientific results

d) autonomy and responsibility
- Ability to perform engineering tasks individually
- Initiative to solve engineering problems
- Making professional decisions individually within the field

Course coordinator (*name*, *position*, *sci. degree*)**: Dr. Attila Szilágyi, associate professor PhD.**

Course: **Design**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 50 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: practicing task	
Frequency of course: **3. semester**	
Prerequisites:	

The brief description of the course:

Content and interpretation of design. Developing of applied arts and design. Periods of industrial and product design in last centuries. Art Nouveau. DWB. Forms follow function. Results of mass production in Europe and United States before II. World War. New design directions and results after II. World War. Basic knowledge of industrial product design. Analyses and solving of design problems.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Herbert Read: Art and Industry. The Principle of Industrial Design by Herbert Read. Faber and Faber limited. London. 205. p.
2. Product Development in Engineering Education. Proceedings of PDiEE'96 Product Development in Engineering Education. 1996. 317 p.
3. Ernyey Gyula: Design. Dialóg Campus. Budapest-Pécs, 2000. 350p.
4. Lissák György: A formáról. Láng Kiadó és Holding Rt. Budapest, 1998.223p.
5. Noel Riley: Stílusok és formák. Glória Kiadó, Budapest, 544p.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Comprehensive understanding of global social and economic processes

b) skills
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way
- Ability to organise cooperation with experts from related fields to solve problems

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering
- Commitment to professional and ethical values related to engineering

d) autonomy and responsibility
- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways
- Ability to perform engineering tasks individually
- Acting independently and initiatively to solve professional problems
- Responsibility for sustainability, health and safety culture at work, as well as environmental consciousness

Course coordinator (*name, position, sci. degree*)**: Dr. Ágnes Judit Takács, associate professor, PhD**

Teachers involved in course (*name, position, sci. degree*)**: Dr. Csaba Dömötör associate professor PhD**

Course: **Project work A**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 50 (credit%)	
Class type: pract., no. of classes/term: 28, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: -	
Frequency of course: **3. semester**	
Prerequisites:	

The brief description of the course:

In the Project A tasks, students are dealing with a given industrial problem from a special field of the computer aided design and manufacturing. During the solution of the Project A task consultant from the industry and/or the department help, but students need to be initiative and later self-sufficient. Solution templates do not exist for the project design tasks, because each job is unique.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Takács, Gy., Oláhné, LJ.: Projekt feladat, Útmutató és segédlet, 2011.University of Miskolc (*partly translated*)
Balogh, A.: Diplomatervezés, Útmutató és segédlet, 2006. University of Miskolc

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge and understanding of terminology, main regulations and aspects of other areas relating to and having a priority for practising engineering (primarily that of logistics, management, environmental protection, quality assurance, information technology, law, economics, occupational and fire safety, industrial safety)
- A detailed knowledge and understanding of mechanisms of knowledge acquisition and methods for data collection, their ethical barriers and problem-solving techniques related to the engineering field
- A comprehensive understanding of the main properties and application fields of structural materials related to mechanical engineering
- Have a detailed knowledge of the rules of preparing technical documentations
- Knowledge of measurement techniques and theory related to mechanical engineering

b) skills
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to apply integrated knowledge from the field of machines, mechanical engineering devices, systems and processes, engineering materials and technologies, as well as related electronics and informatics

c) attitude
- Commitment to professional and ethical values related to engineering

- Striving to participate in the development of new methods and equipment related to engineering. A deep sense of vocation
- Striving to continuously improve their own and their colleagues' knowledge through further and self-education
- Striving to comply with and enforce the ethical principles of work and organisational culture
- Striving to design and perform tasks individually or in a team at a professionally high level

d) autonomy and responsibility

- Ability to perform engineering tasks individually
- Initiative to solve engineering problems
- Taking responsibility for sub-processes under their control
- Encouraging colleagues and subordinates to practising engineering in a responsible and ethical way
- Responsibility for sustainability, health and safety culture at work, as well as environmental consciousness
- Make decisions based on principles and applicability of environmental protection, quality assurance, consumer protection, product responsibility, equal rights to accessibility, as well as the basic principles of occupational health and safety, technological, economic and legal regulations, moreover basic requirements of engineering ethics

Course coordinator (*name, position, sci. degree*)**: Dr. Attila Szilágyi, associate professor PhD.**

Teachers involved in course (*name, position, sci. degree*)**:**

Dr. György Hegedűs, associate professor, PhD

Dániel Kiss, assistant lecturer;

Dr. Marcell Gyula Gáspár senior lecturer, PhD

Dr. Andrea Biró, Szilágyiné associate professor, PhD

Course: **Project Management**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: pract., no. of classes/term: 28, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: computer	
Frequency of course: **4. semester**	
Prerequisites:	

The brief description of the course:

Basic definitions of Project management. Project life cycle. Project scope management, work breakdown structure. Time planning: Gantt chart, network plan. Project risk management.Project stakeholders. Project monitoring techniques. Project roles, project competences. Competence measurement and feedback. SAP PS module: project planning and monitoring. Individual problem solving in SAP PS.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Kötelező:
- Course material (ppt) and handouts (uploaded to http://szervez.uni-miskolc.hu)
- Verzuh, E: Fast forward in project management, Wiley, 2016.
- SAP PS case studies.

Ajánlott:
- PMI Standards Committee: Project Management Body of Knowledge, 2006.
- J. G. Monks: Operations Management, McGraw-Hill, 1982. Chapters 12, 13.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Comprehensive understanding of global social and economic processes
- Knowledge and understanding of terminology, main regulations and aspects of other areas relating to and having a priority for practising engineering (primarily that of logistics, management, environmental protection, quality assurance, information technology, law, economics, occupational and fire safety, industrial safety)
- Understanding of the organizational tools and methods of management, relevant legislation necessary for practising engineering

b) skills
- Ability to organise cooperation with experts from related fields to solve problems
- Ability to apply information and communication technologies and methods to solve engineering problems
- Ability to perform managerial tasks after gaining practical experience
- Ability to design complex systems using a system approach and process oriented way of thinking

c) attitude
- Striving to design and perform tasks individually or in a team at a professionally high level
- Striving to perform work in a complex, system based and process oriented way

d) autonomy and responsibility
- Making professional decisions individually within the field

- Making informed decisions individually after consultations with representatives from diverse fields (primarily that of law, economics, energy management, environmental protection), taking responsibility for the decisions

Course coordinator (*name, position, sci. degree*)**: Dr. Viktor MOLNAR, associate professor, PhD**
Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Polymer Processing**	**Credits: 4**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: -	
Frequency of course: **4. semester**	
Prerequisites: ICAD systems I.	

The brief description of the course:

Material knowledge of plastics and their specific properties of forming. Detailed discussion of the technological variants of plastic forming, touching on the basic designs of machine and tool solutions. Planning methods for plastic forming processes. Analyze the technological design process taking into account the requirements of computer design. Structure and application of expert systems in the process of technological design. Tool design in the NX Mold Wizard system. Structure and function of the NX Mold Wizard program. Understand the operation of the Databases Database. Drawing on the foundations of plastic forming students are prepared to acquire the design of plastic forming tools and can connect to the plastics processing plants.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. R. J. Crawford: Plastics engineering, 3rd Edition, Imprint: Butterworth-Heinemann, 1998. ISBN: 9780750637640
2. Zeid, I.: CAD/CAM Theory and Practice, Mc Graw Hill, Inc. New York, 1991. p. 1-1052.
3. Groover, M., Zimmers, E.: Computer Aided Design and Manufacturing, Prentice Hall Inc., New Jersey, 1994. p. 1-489

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge and understanding of devices and methods of computer modelling and simulation related to mechanical engineering
- Broad theoretical and practical background as well as methodological and practical knowledge of design, manufacture, operation and control of complex mechanical systems and processes
- A comprehensive understanding of the methods used in machine, system and process design in the field of mechanical engineering

b) skills
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to solve specific engineering problems by applying modern knowledge acquisition and data collection methods
- Ability to solve problems in a creative, and complex tasks in a flexible way, as well as to pursue life-long learning and to demonstrate a commitment to diversity and value-basedness

c) attitude
- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering

- Striving to participate in the development of new methods and equipment related to engineering. A deep sense of vocation
- Striving to design and perform tasks individually or in a team at a professionally high level
- Striving to perform work in a complex, system based and process oriented way

d) autonomy and responsibility

- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways
- Ability to perform engineering tasks individually
- Making professional decisions individually within the field

Course coordinator (*name, position, sci. degree*)**: Dr. Péter Zoltán Kovács, associate professor, PhD**

Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **NC Programming**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 55-45 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **4. semester**	
Prerequisites:	

The brief description of the course:

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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Topsolid User's Guide and Help
2. Helmi A. Youssef, Hassan El-Hofy: Machining Technology – Machine tools and operations, 2008.
3. J. Paulo Davim: Machining of Complex Sculptured Surfaces, 2012.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge and understanding of terminology, main regulations and aspects of other areas relating to and having a priority for practising engineering (primarily that of logistics, management, environmental protection, quality assurance, information technology, law, economics, occupational and fire safety, industrial safety)
- Knowledge and understanding of devices and methods of computer modelling and simulation related to mechanical engineering

b) skills
- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to solve specific engineering problems by applying modern knowledge acquisition and data collection methods.

c) attitude
- Striving to comply with and enforce quality standards
- Striving to design and perform tasks individually or in a team at a professionally high level.

d) autonomy and responsibility
- Taking responsibility for sub-processes under their control
- Responsibility for sustainability, health and safety culture at work, as well as environmental consciousness

Course coordinator (*name, position, sci. degree*)**: Dr. György Hegedűs, associate professor, PhD.**

Teachers involved in course (*name, position, sci. degree*)**: Dániel Kiss, assistant lecturer**

Course: **Materials Selection**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 50-50 (credit%)	
Class type: lect. + pract., no. of classes/term: 28+14, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): exam Any other ways of assessment *(if applied)*: -	
Frequency of course: **4. semester**	
Prerequisites:	

The brief description of the course:

The aim and scope of Materials Selection. 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.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

1. Ashby, F. M.: *Materials Selection in Mechanical Design*, Cambridge University Press, Cambridge, 2004. p. 1-246.
2. ASM Handbook, Volume 20: Materials Selection and Design, ASM International, London, 1997. ISBN 0-87170-386-6, p. 1-900.
3. Kutz, M.: *Handbook of Materials Selection*, John Wiley, New York, 2002. p. 1-564.

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field
- A comprehensive understanding of the main properties and application fields of structural materials related to mechanical engineering
- Knowledge of measurement techniques and theory related to mechanical engineering
- Knowledge and understanding of devices and methods of computer modelling and simulation related to mechanical engineering
- Broad theoretical and practical background as well as methodological and practical knowledge of design, manufacture, operation and control of complex mechanical systems and processes.

b) skills
- Ability to solve specific engineering problems by applying modern knowledge acquisition and data collection methods
- Ability to study and analyse the materials used in mechanical engineering in a laboratory, as well as to assess and document research results
- Ability to process, systemise and analyse information gained through the operation of mechanical systems and processes, as well as to draw conclusions
- Ability to apply and further develop procedures, models and information technologies used in the design, organisation and operation of mechanical systems and processes.

c) attitude

- Striving to participate in the development of new methods and equipment related to engineering. A deep sense of vocation
- Striving to organise and perform tasks in accordance with environmentally and health conscious, as well as sustainability expectations

d) autonomy and responsibility

- Ability to perform engineering tasks individually.

Course coordinator (*name, position, sci. degree*)**: Dr. Zsuzsanna Koncsik, associate professor, PhD.**

Teachers involved in course (*name, position, sci. degree*)**:**

Dr. László Kuzsella, associate professor, PhD.

Course: **Mechatronical Modelling**	**Credits: 3**

Labelling of course: **compulsory optional**

Rate of practical or theoretical content: 60-40 (credit%)

Class type: lect. + pract., no. of classes/term: 28+14,
(*language*: *English)*
Any other ways of knowledge dissemination *(if applied)*: -

Assessment (exam. / term-mark / **any other**): exam
Any other ways of assessment *(if applied)*: -

Frequency of course: **4. semester**

Prerequisites:

The brief description of the course:

Holonomic, non holonomic constrains, virtual displacements. Stored energies of conservative mechatronical elements, kinetic co-energy, potential energy, magnetic energy, electric energy, magnetic co-energy, electric co-energy. Virtual works of non conservative mechatronics elements. Extended Hamilton's principle, Lagrange differential equation of second kind. Derivation of differential equations with charge and displacement formulations. Application of Laplace transformation, obtaining transfer functions. State space equations. Numerical solution of differential equations using Euler explicit method and trapezoid implicit method. Simulation blocks in MATLAB/SCILAB environment. Models of DC motor, electric circuits, quarter car, plunger, PID controlling. Analysis of nonlinear problems.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Obligatory literature:

Dieter Schram: Mechatronical Modelling, University of Duisburg-Essen, 2014.

Recommended literatures:

Robert H. Bishop: The Mechatronics Handbook, 2002 CRC Press, Boca Raton-London-New York-Washington, D.C.

Klaus Janschek: Mechatronic Systems Design (Methods, Models, Concepts), Springer-Verlag Berlin, Heidelberg 2012

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge
- Knowledge and understanding of devices and methods of computer modelling and simulation related to mechanical engineering
- Broad theoretical and practical background as well as methodological and practical knowledge of design, manufacture, operation and control of complex mechanical systems and processes,

b) skills
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way
- Ability to apply information and communication technologies and methods to solve engineering problems,

c) attitude
- Striving to perform work in a complex, system based and process oriented way,
- Striving to understand, describe and explain observable phenomena as thoroughly as possible applying the engineering knowledge acquired,

d) autonomy and responsibility
- Ability to perform engineering tasks individually,
- Initiative to solve engineering problems

Course coordinator (*name, position, sci. degree*)**: Dr. Tamás Szabó, associate professor, PhD.**
Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Logistics Systems**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 60-40 (credit%)	
Class type: lect., no. of classes/term: 28, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: -	
Frequency of course: **4. semester**	
Prerequisites:	

The brief description of the course:

Introduction to logistics. Logistics principles and aims. Logistics tendencies and challenges. Key logistics processes and operations. Material and information flow in the logistics systems. Logistics sub-systems: procurement logistics, production logistics, distribution logistics, recycling logistics. Supply Chain management. Typical manufacturing systems and logistics services. Push and pull philosophies. JIT and Kanban principle in manufacturing and procurement. Lean manufacturing. Transportation infrastructures and operations. Principles and operations of warehousing, inventory management. Logistics costs. Logistics controlling.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Donald J. Bowersox, David J. Closs, M. Bixby Cooper: Supply Chain Logistics Management, McGraw-Hill International Edition, 2010., ISBN 978-007-127617-7
Alan Rushton, Phil Croucher, Peter Baker: The Handbook of Logistics and Distribution Management, Kogan Page Limited, 2017., ISBN 978-0-7494-4669-7

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Knowledge of fundamental theories, relations, and the terminology used in the engineering field
- Knowledge and understanding of basic principles, boundaries of the epistemic and functional system of the engineering field and the expected directions of development and innovation
- Knowledge and understanding of terminology, main regulations and aspects of other areas relating to and having a priority for practising engineering (primarily that of logistics, management, environmental protection, quality assurance, information technology, law, economics, occupational and fire safety, industrial safety)
- Broad theoretical and practical background as well as methodological and practical knowledge of design, manufacture, operation and control of complex mechanical systems and processes

b) skills

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to approach and solve special problems arising in engineering in a versatile, interdisciplinary way
- Ability to publish research work, make presentations and hold discussions in their field in their mother tongue and at least in one foreign language
- Ability to design complex systems using a system approach and process oriented way of thinking

c) attitude

- Openness and aptness to know, accept and credibly communicate professional and technological development and innovation in engineering
- Striving to perform work in a complex, system based and process oriented way
- Commitment to enrich the field of mechanical engineering with new findings and scientific results

d) autonomy and responsibility

- Sharing acquired knowledge and experience with representatives of the field communicating in formal, non-formal and informal ways
- Ability to perform engineering tasks individually
- Initiative to solve engineering problems
- Acting independently and initiatively to solve professional problems

Course coordinator (*name, position, sci. degree*)**: Dr. György Kovács**, associate professor, PhD

Teachers involved in course (*name, position, sci. degree*)**: -**

Course: **Project work B**	**Credits: 3**
Labelling of course: **required**	
Rate of practical or theoretical content: 50-50 (credit%)	
Class type: pract., no. of classes/term: 28, (*language*: *English)* Any other ways of knowledge dissemination *(if applied)*: -	
Assessment (exam. / term-mark / **any other**): term mark Any other ways of assessment *(if applied)*: -	
Frequency of course: **4. semester**	
Prerequisites:	

The brief description of the course:

In the Project B tasks, students are dealing with a given industrial problem from a special field of the computer aided design and manufacturing. During the solution of the Project B task consultant from the industry and/or the department help, but students need to be initiative and later self-sufficient. Solution templates do not exist for the project design tasks, because each job is unique.

2-5 compulsory and suggested readings (lecture notes, books) with bibliographic data (author(s), title, publication data, (pages), ISBN)

Takács, Gy., Oláhné, LJ.: Projekt feladat, Útmutató és segédlet, 2011. (*partly translated*)

List of all those professional competences and elements (knowledge, skills etc) which the course most significantly contributes to:

a) knowledge

- Knowledge and understanding of terminology, main regulations and aspects of other areas relating to and having a priority for practising engineering (primarily that of logistics, management, environmental protection, quality assurance, information technology, law, economics, occupational and fire safety, industrial safety)
- A detailed knowledge and understanding of mechanisms of knowledge acquisition and methods for data collection, their ethical barriers and problem-solving techniques related to the engineering field
- A comprehensive understanding of the main properties and application fields of structural materials related to mechanical engineering
- Have a detailed knowledge of the rules of preparing technical documentations
- Knowledge of measurement techniques and theory related to mechanical engineering

b) skills

- Knowledge of general and specific principles, rules, relations and procedures pertaining to mathematics, natural and social sciences necessary to work in the field of engineering
- Ability to solve problems using engineering theories and related terminology in an innovative way
- Ability to apply integrated knowledge from the field of machines, mechanical engineering devices, systems and processes, engineering materials and technologies, as well as related electronics and informatics

c) attitude

- Commitment to professional and ethical values related to engineering
- Striving to participate in the development of new methods and equipment related to engineering. A deep sense of vocation
- Striving to continuously improve their own and their colleagues' knowledge through further and self-education
- Striving to comply with and enforce the ethical principles of work and organisational culture
- Striving to design and perform tasks individually or in a team at a professionally high level

d) autonomy and responsibility

- Ability to perform engineering tasks individually
- Initiative to solve engineering problems
- Taking responsibility for sub-processes under their control
- Encouraging colleagues and subordinates to practising engineering in a responsible and ethical way
- Responsibility for sustainability, health and safety culture at work, as well as environmental consciousness
- Make decisions based on principles and applicability of environmental protection, quality assurance, consumer protection, product responsibility, equal rights to accessibility, as well as the basic principles of occupational health and safety, technological, economic and legal regulations, moreover basic requirements of engineering ethics

Course coordinator (*name, position, sci. degree*)**: Dr. Attila Szilágyi, associate professor, PhD**

Teachers involved in course (*name, position, sci. degree*)**:**

Dr. György Hegedűs, associate professor, PhD

Dániel Kiss, assistant lecturer;

Dr. Marcell Gyula Gáspár senior lecturer, PhD

Dr. Andrea Biró, Szilágyiné associate professor, PhD