1. Subject name, code: Economics	
2. Name of course, level of education: Vehicle engineer BSc	**3. Language:** English
4. Subject category: Compulsory subject	**5. Evaluation:** Colloquium
6. Number of lessons per week (lecture+ exercise + lab): **Number of consultation hours:**	**7. Credit value:**
8. Location of the subject: 3 semester	**9. Type of lecture:** Correspondence course
10. Prerequisites: There is no prerequisite	
11. Department:	
12. Subject coordinator:	
13. The teacher of the subject:	

14. Subject description (published in Neptun)
The aim of teaching the subject:

The aim is to introduce students to the fundamental problems of economics, its operation, micro- and macroeconomics, the economic context of technical life.

The knowledge to be acquired:

Economics as an empirical science. Economic problems of technical life. Basics of Finance - Microeconomics. The operation, actors and peculiarities of the market economy. Macroeconomics. Measuring economic performance. Operation and peculiarities of macro markets.

Professional competences to be acquired (knowledge, skills, attitudes, autonomy and responsibility):

Students gain knowledge of economics through problem analysis. Students will be able to identify and deal with economic (technical-economic) problems. Students strive to mobilize their knowledge in the course of their work. Students have sufficient responsibility to deal with economic (technical-economic) problems.

15. System of assessment and evaluation (published in Neptun)
Examination requirements:

A. Economic accounting tasks
B. Answering an economic theory question

16. Study aids, laboratory background:

17. List of the 2-5 most important compulsory or recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, ISBN) (published in Neptun):

- Károlyné Dóra Margit (2006): *Közgazdaságtan I-II.* GAMF
  Azonosító: KF-GAMFK-H-372
- Paul A. Samuelson & William D. Nordhaus (2010): *Economics*. Mcgraw-Hill Irwin.

  ISBN(s): 978-0-07-351129-0

1. Subject name, code: Fluid Dynamics

2. Name of course, level of education: Vehicle engineer BSc	**3. Language:** English
4. Subject category: Compulsory subject	**5. Evaluation:** Exam
6. Number of lessons per week (lecture+ exercise + lab): 2+1+0 **Number of consultation hours:**	**7. Credit value:** 3
8. Location of the subject: 3. semester	**9. Type of lecture:** Regular course

10. Prerequisites:

11. Department: Department of Basic Sciences

12. Subject coordinator: Péter Nagy, PhD

13. The teacher of the subject: Mihály Görbe, PhD.

14. Subject description (published in Neptun)

The aim of teaching the subject:

Presentation of the most basic concepts, laws and methods of description of stagnant and flowing liquids and gases. Typing, modeling and introducing the solution processes of real systems in technical practice.

The knowledge to be acquired:

Stationary liquids and gases: Physical characteristics of liquids and gases. Pascal's law. Compressibility of liquids. The force field of difficulty and inertia. Behavior of the resting fluid. The free surface of the liquid. Fluid pressure in gravity field. Archimedes' law. The fluid is in an inertial force field. Tension in the pipe wall.

Flow of frictionless liquids and gases: Description of flowing liquids. Average speed, volume flow, mass flow. The continuity theorem. Power requirement for flow. The amount of motion and the Euler equation. The Bernoulli equation and its technical applications: Pitot tube, Prandtl tube. Venturi, water air pump, liquid spray. Momentum and its application to fluid contained in a stream tube. The force of the free jet on a plane. The flat-bladed water wheel, the Pelton wheel.

Flow of frictional liquids and gases: Internal friction. Newton's law of viscosity. The Reynolds experiment and the Reynolds number. Layered and billowing flow. Boundary layer theory. Slip on oil film. The unloaded plain bearing. Layered flow in a cylindrical tube: the Hagen-Poiseuille law. Friction loss of billowing flow in cylindrical tube: surface roughness, tube friction factor. Forces acting on circulating solids. Elements of wing aerodynamics. Movement of ships in the water. Similarity of flows. Numerical finite-element methods of fluid dynamics.

Professional competences to be acquired (knowledge, skills, attitudes, autonomy and responsibility):

The student knows the general and specific mathematical, natural and social science principles, rules, connections and procedures required for the cultivation of vehicles and mobile machines. Able to identify routine professional problems, model technical systems and processes, explore and formulate the theoretical and practical background needed to solve them (using practical operations in practice).

15. System of assessment and evaluation (published in Neptun)

Semester requirements:

Writing four short papers at lectures at unannounced times. A pocket calculator can be used for dissertation writing, as well as a flat, double-sided (A4 size) collection of formulas in your own handwriting (not photocopied, not printed). The time available for their elaboration is 15-20 minutes, their score is 10-15 points, so the maximum that can be obtained is F = 50. These papers cannot be replaced or repaired. There is no score requirement for admission to the exam.

Examination requirements:

Writing an exam paper (50 points).

Score obtained with mid-semester tests (F) 50 points
Score obtained with exam (V) 50 points

P point is calculated from F test-points and V exam-points by:
P=106,5-sqrt(125*(50,3125-F-V+F*V/50))
Grade is determined based on P score points as follows:
Under 50 points: 1, 50-65[points: 2, [65-80[points: 3, [80-90[points::4, from 90 points: 5.

16. Study aids, laboratory background:

Downloadable resources.

17. List of the 2-5 most important compulsory or recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, ISBN) (published in Neptun):

[1] C. Pozrikidis: Fluid Dynamics. Springer Verlag, 2009. (ISBN 978-1-4899-7990-2)

[2] Y. A. Cengel, J. M. Cimbala: Fluid Mechanics, McGraw-Hill, 2006, ISBN 0–07–247236–7 (web: https://imtk.ui.ac.id/wp-content/uploads/2014/02/Fluid-Mechanics-Cengel.pdf)

1. Subject name, code: Machine elements I.	
2. Name of course, level of education: Vehicle engineer BSc	**3. Language:** English
4. Subject category: Compulsory subject	**5. Evaluation:** Mid-term grade
6. Number of lessons per week (lecture+ exercise + lab): 2+2+0 **Number of consultation hours:** 16	**7. Credit value:** 4
8. Location of the subject: 3rd semester	**9. Type of lecture:** Regular course
10. Prerequisites: Technical illustration	
11. Department: Department of Innovative Vehicles and Materials	
12. Subject coordinator: Attila Piros, PhD	
13. The teacher of the subject: Attila Piros, Gergely Ivánovics, Béla Csorba	

14. Subject description (published in Neptun)

The aim of teaching the subject:

The aim of the course Machine elements I is to familiarise students with the type of machine elements and design of them.

The knowledge to be acquired:

Categorization of machine elements. Basics of technical calculations and product design. Static and dynamic dimensioning and analysis of machine elements. Dimensioning of screw joints and calculation of torques at threads. Design of sliding and rolling bearings, selection and verification of them. Design, calculation and verification of axes. Force and form locking joints. Theory and design of welded, soldered and glued joints. Design and calculation of frame structures.

Professional competences to be acquired (knowledge, skills, attitudes, autonomy and responsibility):

The student will become familiar with the basic facts, interrelationships, limits and boundaries of the knowledge and activity system of the field of design, calculations and verification of machine elements. He/she is able to apply the acquired technical scientific principles, rules, contexts and procedures in solving routine tasks in the field of mechanical engineering. Ability to understand and process technical documentation. Open to general and specific knowledge underpinning the technical discipline. Is able to evaluate realistically the results of his/her own work.

15. System of assessment and evaluation (published in Neptun)

Semester requirements:

During the semester, there are two mid-term performance appraisals, which can be corrected or made up once. A satisfactory results in both of appraisals are a prerequisite for obtaining a satisfactory mid- term grade.

Examination requirements:

16. Study aids, laboratory background:

17. List of the 2-5 most important compulsory or recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, ISBN) (published in Neptun):

Fazekas László: Gépelemek Tervezési segédlet (H-286).
Szendrő Péter (szerk.): Gépelemek, Mezőgazdasági Kiadó, 2007.
Zsáry Árpád: Gépelemek I.-II. Tankönyvkiadó, Budapest, 1991.
Diószegi György: Gépszerkezetek példatár,
Herczeg István: Szerkesztési Atlasz.

1. Subject name, code: Mathematics III.

2. Name of course, level of education: Vehicle engineer BSc	**3. Language:** English
4. Subject category: Compulsory subject	**5. Evaluation:** Exam
6. Number of lessons per week (lecture+ exercise + lab): 3+1+1 **Number of consultation hours:**	**7. Credit value:** 5
8. Location of the subject: 3. semester	**9. Type of lecture:** Regular course

10. Prerequisites:

11. Department: Department of Basic Sciences

12. Subject coordinator: József Osztényi, PhD

13. The teacher of the subject: József Osztényi, PhD

14. Subject description (published in Neptun)

The aim of teaching the subject:

The aim of the course is to make the students learn the basic concepts and tools of advanced mathematical analysis that are necessary and required in engineering studies and later on in their profession.

The knowledge to be acquired:

Differential geometry: curves and surfaces. Line and surface integrals of vector-valued functions.
Divergence and curl of a vector field. Green's and Stokes's Theorem.
Complex functions: limits, continuity and differentiation. Elementary and regular complex funtions. Integration of complex function. Cauchy's integral formula.
Random experiment, frequencies. Elementary probability models. Probability spaces. Conditional probability and independence. Random variables. Distribution function and density function. Expected value, variance and moments. Statistical sample, empirical distribution function. Estimating the expectation and the variance. Point estimations: maximum-likelihood method. Confidence intervals. Hypothesis testing: compare means: u-test, one sample t-test, two samples t-test. Estimating the covariance and correlation. Linear regression.

Professional competences to be acquired (knowledge, skills, attitudes, autonomy and responsibility):

The students will become familiar with the basic concepts and tools of advanced mathematical analysis, they know and understand the scientific principles, relations and procedures that are necessary and required in engineering professions. They will be able to recognize a problem of higher mathematics, identify the adequate method to solve it and they can apply the method in a quick and precise manner. They are able to build an adequate mathematical model for a given technical problem, to generalize it for similar cases.

15. System of assessment and evaluation (published in Neptun)

Semester requirements:

During the semester three tests will be written, for 20-20 points. At the end of the semester the students can write one test to increase their points by replacing the results by the new one.

Examination requirements:

In the exam period the students write an exam for 40 points. They will be evaluated based on their total points (at most 100 possible) according to the valid TVSZ (regulation of study and examination).

16. Study aids, laboratory background:

17. List of the 2-5 most important compulsory or recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, ISBN) (published in Neptun):

George B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano: Thomas' Calculus,Pearson, 2018.

Joseph Bak , Donald J. Newman: Complex Analysis, Springer-Verlag New York Inc., 2010.

Marco Taboga: Lectures on Probability Theory and Mathematical Statistics, CreateSpace Independent Publishing Platform, 2017.

1. Subject name, code: Measurement in Mechanical Engineering	
2. Name of course, level of education: Vehicle engineer BSc	**3. Language:** English
4. Subject category: Compulsory subject	**5. Evaluation:** Mid-term grade
6. Number of lessons per week (lecture+ exercise + lab): **Number of consultation hours:** 12	**7. Credit value:**
8. Location of the subject: 3. semester	**9. Type of lecture:** Correspondence course
10. Prerequisites:	
11. Department: Department of Innovative Vehicles and Materials	
12. Subject coordinator: Katalin Líska, PhD	
13. The teacher of the subject:	

14. Subject description (published in Neptun)

The aim of teaching the subject:

The aim of the course Measurements in Mechanical Engineering is to present to the students length measurements used in this field.

Students will learn about the optical measurements, deviation measurements, surface roughness measurements and other methods.

The knowledge to be acquired:

By completing the course, the student will get a basic knowledge from the theoretical and practical part of this field. He learns the practical series of steps at measurement. He will acquire the process of gauge design.

Professional competences to be acquired (knowledge, skills, attitudes, autonomy and responsibility):

The student will become familiar with the basic facts, interrelationships, limits and boundaries of the knowledge. He/she is able to apply the acquired knowledge at different measurements.

He acquires also knowledge from the process of technical documentation.

15. System of assessment and evaluation (published in Neptun)

Semester requirements:

During the semester, one final examination will be written, which can be corrected or made up once. The prerequisite of satisfactory result in the final examination is obtaining a satisfactory mid-semester grade and successful completion of laboratory practice.

Examination requirements:

16. Study aids, laboratory background:

17. List of the 2-5 most important compulsory or recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, ISBN) (published in Neptun):

1. David Whitehouse: Surfaces and their Measurement. Kogan Page Science 2002, ISBN 1 9039 9660 0

2. Toru Yoshizawa: Handbook of optical metrology. CRC Press 2009, ISBN 978-0-8493-3760-4

1. Subject name, code: Engineering Mechanics III./Dynamics	
2. Name of course, level of education: Vehicle engineer BSc	**3. Language:** English
4. Subject category: Compulsory subject	**5. Evaluation:** Examination
6. Number of lessons per week (lecture+ exercise + lab): 2+2+0 **Number of consultation hours:**	**7. Credit value:** 4
8. Location of the subject: 3rd semester	**9. Type of lecture:** Regular course
10. Prerequisites: Engineering Mechanics II./Strength of Materials	
11. Department: Department of Science and Engineering	
12. Subject coordinator: LAKÓ, Sándor, PhD	
13. The teacher of the subject: GÖRBE, Mihály, PhD, LAKÓ, Sándor, PhD, IVÁNOVICS, Gergely; CSORBA, Béla	

14. Subject description (published in Neptun)

The aim of teaching the subject:

Introduction of the students to the description of the motion of bodies (kinematics), and exploring the relationship between the forces acting on bodies and the resulting motion (dynamics/kinetics). Demonstrates the application of the fundamental theorems to the analysis of the motion of simple structures made of rigid bodies.

The knowledge to be acquired:

Kinematics of point masses. Planar motions.
Kinematic diagrams. Kinematics of rigid bodies: velocity and acceleration state of rigid bodies in planar motions.
Finite motions of rigid bodies. Kinematics of mechanisms. Velocity state of mechanisms.
Speed and acceleration states of four-bar linkages and crank mechanisms. Kinetics of point masses.
Kinetic theorems. Kinetics of loose and rigid point mass systems.
Kinetics of rigid bodies. Moment of inertia. Rotational motions of rigid bodies.
Physical pendulum. General planar motions of rigid bodies. Rolling motion.
Investigation of complex structures with single degree of freedom by decomposition. Calculation of internal forces.
Investigation of complex structures with single degree of freedom by decomposition by reduction of mass and force. Basic concepts of collisions.
Centric and eccentric collisions of rigid bodies.
Relationship between velocities, accelerations and forces in different coordinate systems.
Basic concepts of vibrational motions.

Professional competences to be acquired (knowledge, skills, attitudes, autonomy and responsibility):

Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.
Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the field of engineering.
Comprehensive knowledge of the operating principles and structural units of the machines, power tools, mechanical equipment and tools used.
Knowledge of measurement procedures, instruments, apparatus and measuring equipment used in mechanical engineering.
Ability to analyse at a basic level the disciplines making up the knowledge base of the field of engineering, to formulate relationships synthetically and to carry out appropriate evaluative activities.
Ability to identify routine technical problems and to identify, formulate and solve (using standard operations in practice) the theoretical and practical background required to solve them.
Ability to construct basic models of technical systems and processes.
Ability to communicate orally and in writing in his/her mother tongue and at least one foreign language in a professionally appropriate manner in his/her field of specialisation.
Open to understanding, accepting and authentically communicating professional and technological developments and innovations in the field of engineering.

Applies his/her acquired technical knowledge to gain the best possible understanding of observable phenomena and to describe and explain their laws.

15. System of assessment and evaluation (published in Neptun)

Semester requirements:

Depending on the evolution of the emergency situation and the decisions/recommendations of the faculty committee for method of assessment, changes may be possible in this point.

Two tests will be written at the lectures. Only writing utensils and pocket calculators not suitable for storing textual information may be used for writing the short tests. The tests will take 90 minutes and will be worth 50 points. Admission to the examination (Article 11 of the Exam Rules): a total score of 50 or more at the start of the examination period. A replacement test worth of 100 points (on the last week before the exam period) can be written by the students, who are not admitted to the exam by the regular test. The score of the replacement test overwrites the full score of the semester, and the condition of the exam admission re-evaluated.

Examination requirements:

Depending on the evolution of the emergency situation and the decisions/recommendations of the faculty committee for method of assessment, changes may be possible in this point.

The exam is written, lasts 90 minutes and is worth 100 points. It may contain questions regarding the material presented in the lectures and the material given for individual work, and regarding the exercise lessons, including theoretical questions and calculation problems requiring textual descriptions, drawings. Preparation for the theoretical part is aided by the examination thematics, which is published at the end of the semester. The following may be used in the examination: writing utensils, pocket calculators not suitable for storing textual information and a handwritten (not photocopied or printed) two-sided A5 format sheet of formulae written in blue pen. Half of the points above 50 obtained during the period of study will be added to the examination score. The examination mark will be determined in accordance with the table in § 11(2) of the Exam Rules.

16. Study aids, laboratory background:

Video explanations regarding the parts of the material assigned for individual work.

Documents, slides, tables published on Teams and/or Neptun Meet Street.

17. List of the 2-5 most important compulsory or recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, ISBN) (published in Neptun):

Hudson–Nelson: University Physics, Saunders College Publishing, 1990

Beer–Johnston: Vector Mechanics for Engineers. Dynamics. McGraw-Hill, 2004.

Tongue–Sheppard: Dynamics. Analysis and Design of Systems in Motion. John Wiley ans Sons, 2005.

McLean–Nelson: Engineering Mechanics. Statics and Dynamics. Schaum's Outline Series, McGraw-Hill, 1988.

Hibbeler: Engineering Mechanics, Dynamics 11th ed, SI version, Pearson Prentice Hall, 2007.

Meriam–Kraige: Engineering Mechanics, Dynaimics, 5th edition, SI version, John Wiley and Sons, 2003

1. Subject name, code: Vehicle materials and technologies	
2. Name of course, level of education: Vehicle engineer BSc	**3. Language:** English
4. Subject category: Compulsory subject	**5. Evaluation:** Mid-term grade
6. Number of lessons per week (lecture+ exercise + lab): 2+2+0 **Number of consultation hours:**	**7. Credit value:** 4
8. Location of the subject: 3. semester	**9. Type of lecture:** Regular course
10. Prerequisites: Material science J	
11. Department: Department of Innovative Vehicles and Materials	
12. Subject coordinator: Zoltán Weltsch, PhD	
13. The teacher of the subject: Miklós Berczeli	

14. Subject description (published in Neptun)

The aim of teaching the subject:

The aim of the course Vehicle materials and technologies is to familiarise students with the properties of materials used in the automotive industry and how to modify them. Students will learn about the technological conditions and the theoretical background of heat treatments, metal forming, joining technologies, modern structural materials and surface treatment processes.

The knowledge to be acquired:

Properties of materials used in vehicle construction and the technologies that affect their properties (heat treatments, surface treatments). Properties of steels used in vehicle construction. Non-ferrous metals and their alloys used in vehicles. Production and properties of castings. Powder metallurgy and the manufacture of powder metallurgy products. Fundamentals of the plasticity of metals. Flow conditions. Formability of plates. Classification of plate machining technologies. Detailed treatment of cutting, cutting out, punching. Plate forming processes: theory of bending, V-forming, U-forming technologies, tools. Theory and principles of deep drawing. Maximum force required for deep drawing, design of deep drawing tools. Special forming technologies. Shaping of body panels. Basics of welding metals. Welding procedures. Fundamentals and properties of brazing. Thermal cutting of metals. Joining technologies used in automotive engineering.

Professional competences to be acquired (knowledge, skills, attitudes, autonomy and responsibility):

The student will become familiar with the basic facts, interrelationships, limits and boundaries of the knowledge and activity system of the field of engineering and materials technology. He/she is able to apply the acquired technical scientific principles, rules, contexts and procedures in solving routine tasks in the field of engineering. Ability to understand and process technical documentation. Open to general and specific knowledge underpinning the technical discipline. Is able to evaluate realistically the results of his/her own work.

15. System of assessment and evaluation (published in Neptun)

Semester requirements:

During the semester, one final examination will be written, which can be corrected or made up once. A satisfactory result in the final examination is a prerequisite for obtaining a satisfactory mid-semester grade. The mid-term mark is the final examination mark.

Examination requirements:

16. Study aids, laboratory background:

17. List of the 2-5 most important compulsory or recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, ISBN) (published in Neptun):

Serope Kalpakjan, Steven R. Schmid: Manufacturing Engineering and Technology, 8th Edition, Pearson 2019, ISBN-13: 978-0135228609; Ginsztler-Hidasi-Dévényi: Applied Materials Science, University Textbook, Technical University Publishing House 2000. ISBN 963 420 611; Jason Rowe: Advanced Materials in Automotive Engineering, 1st Edition, Elsevier, 2012, ISBN: 9780857095466

1. Subject name, code: Vehicles and Mobile Machines	
2. Name of course, level of education: Vehicle engineer BSc	**3. Language:** English
4. Subject category: Compulsory subject	**5. Evaluation:** Mid-term grade
6. Number of lessons per week (lecture+ exercise + lab): 2+2+0 **Number of consultation hours:**	**7. Credit value:** 5
8. Location of the subject: 3. semester	**9. Type of lecture:** Regular course
10. Prerequisites:	
11. Department: Department of Innovative Vehicles and Materials	
12. Subject coordinator: Levente Balogh, PhD	
13. The teacher of the subject: Levente Balogh, PhD; Péter Kondor	

14. Subject description (published in Neptun)

The aim of teaching the subject:

Get familiar with the role of vehicles and mobile machines in the traffic and transportation with classification and grouping, and acquire basic engineering knowledge about the vehicle subsystems, structure and their physical laws.

The knowledge to be acquired:

Main procedures of vehicle movements. Energy basis of main operations, energy sources of vehicle powertrain and transformation methods of the energy in the different vehicle types. Active and passive forces acting on the vehicle, control of vehicle movement, dynamic and stability situations. Systems of vehicle driveline, direct drive, wheel drive, chain drive, propeller drive. Elements of driveline, clutches, gears, torque transmissions, axle drives, suspensions, structural and operational analysis of brake systems. Dynamic conditions of moving on turning path and the resulted structural requirements. Construction and theoretical requirements of steering, characteristic types. Role of differential and end-transmission, construction and operation analysis. Basis of vehicle suspension systems, spring and damping systems, suspension types, characteristic constructions.

Dynamic of vehicle deceleration and braking, resulted constructional requirements, system and operation analysis of characteristic and modern solutions. Main considerations construction of vehicle chassis and body, additional components and systems and the main tendencies of development.

Professional competences to be acquired (knowledge, skills, attitudes, autonomy and responsibility):

Lexical knowledge of the vehicle systems, synergic view of the used mechanisms, basic vehicle design calculations, analytical mindset.

15. System of assessment and evaluation (published in Neptun)

Semester requirements:

During the semester, one 2 examination will be written, which can be corrected or made up once. A satisfactory result in the final examination is a prerequisite for obtaining a satisfactory mid-semester grade. The mid-term mark is the average of the two examination mark.

Examination requirements:

16. Study aids, laboratory background:

Presentaions of the lectures, examples and exercise materials shared via Teams.

17. List of the 2-5 most important compulsory or recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, ISBN) (published in Neptun):

1. Szerkesztői kollektíva: Gépjármű-szerkezetek. Műszaki Könyvkiadó, Budapest, 2005.
2. Lévai Zoltán: Gépjárművek szerkezettana. Elektronikus oktatási segédlet (http://lezo.hu/szerkezettan)