No.	Subject	ECTS	Description	Remarks
1	**Aerodynamics**	**3**	The course of aerodynamics concerns some selected problems on low and high speeed aerodynamics. 2D panel methods for incompressible flow. 3D wing in incompressible flow: lifting line and vortex lattice method. Measurement techniques for subsonic flows. “shock-expansion” technique for airoils at supersonic speeds. Linearised theory of supersonic flows. Ackeret theory. 3D wing in supersonic flow. Withcomb “area rule”.	
2	**Aircraft construction**	**3**	The aim of the course is to relay basic knowledge to students at the area of general aspects of aircraft configuration development, aircraft general arrangement, overview of the aircraft design process, aircraft initial sizing, searching for the optimum variant, cost analysis and other optimization criteria, aviation regulations and airworthiness standards, aircraft weight analysis, design of main aircraft parts, performance groups and categories and aircraft performance and load analysis. The aim of the course is to introduce students to theoretical and practical knowledge in the scope of: - aircraft configuration, performance and categories groups, - phases of aircraft design, overview of design process, initial specification and sizing, searching for the optimum, impact of civil regulations and airworthiness standards. - aircraft geometry, weight, aerodynamic, performance and cost analysis, - analysis of general aircraft loads, design speeds, maneuvering load limits, gust loads. Aircraft flight envelope. - Analysis of loads distribution - aerodynamic and weight. - Design of main aircraft components.	
3	**Aircraft engine construction**	**4**	Introduction – presentation of types of turbine engines Thrust, specific thrust, fuel consumption, specific fuel consumption, engine efficiency – definitions Turbojet and turbofan and turboprop/turboshaft engine work analyse. Description of ideal and real processes in the engines: - analyse of internal processes in the engine, - engine components losses and efficiencies definition, - engine cycle optimisation, Engine components analyse: inlets, fan/compressor, combustor/afterburner, turbine, propelling nozzle. Performance vs. flight speed and altitude analyse for different engine types.	

4	**Aircraft engine technology**	**3**	Classification and design layouts of aircraft engines. Piston engines. Turbofan and jet engines. Structural materials of aircraft engines. Computer aided design of aircraft engine components. Engine rotors, blades, shafts and bearings. Combustion chambers. Engine auxiliaries and piping. Machining and welding processes in aircraft engine manufacturing. Engine performance and exhaust emission testing on test beds. Engine maintenance. Innovations in aircraft engine design - geared turbofan engines.	
5	**Aircraft production engineering**	**4**	The subject includes fundamental topics related to production engineering in aerospace industry. The goal is to accomplish the production process of aircraft elements in the smoothest, most-judicious and most-economic way. The subject includes: Types of productions; Forms of production organization; Production preparation and start of production of various elements using in aerospace industry; Monitoring and control of production processes of aircraft elements; Reduction and combining technological operations.	
6	**Aircraft structures**	**5**	The aim of the course is to relay basic knowledge to students at the area of general aspects of main aircraft components, material used in airframe construction, major structural stresses, types of aircraft components construction, aircraft configuration, structure of aircraft main components (fuselage, wing, empennage, power plant, landing gear), composite structures, aircraft structure strength, stiffness and fatigue, basics of aircraft production, maintaining and reliability. The aim of the course is to introduce students to theoretical and practical knowledge in the scope of: - principal airframe units, - airframe material properties, examples of material use in airframe construction, - major structural stresses, - basic structure types (truss, monocoque, semi- monocoque), examples of use, properties, - fuselage, wing, empennage, landing gear, power plant structure, - composite structures, application on composites on aircraft, types of composites, material properties, fabric methods, defects and damage, nondestructive Inspection, - airframe strength, stiffness and fatigue properties, - airframe production and repair methods, - airframe maintenance, - airframe reliability.	

7	**Artificial intelligence based optimization in aerospace engineering**	**4**	The main educational goal of the subject is to acquire knowledge and skills in the field of modern methods and techniques called artificial intelligence (AI) systems and their creative application to solve optimization problems in the area of airspace engineering. As part of the lectures, the students get acquainted with the theory of decision-making and learn various AI-based optimization methods. During the workshops, he or she solves optimization tasks by applying the methods, theories, and techniques presented during the lectures. Students propose to use them for solving selected problems that can occur in the area of aviation.	
8	**Aviation law and flight regulations**	**3**	An objective of this course is to give to students general overview of aviation regulations binding in EU. Students are given with the knowledge covering following topics: - general structure of aviation regulation including roles of national and international regulatory institutions, - air traffic regulations affecting organization of aircraft operations - technical regulations - flight training regulations Students are expected to work in group (max three persons per group) to prepare three projects covering main objectives of given topics. The goal of projects is to aim students to understand origins of aviation law and its impact on typical aviation operations.	
9	**CAD/CAM systems**	**3**	CAD/CAM systems overview. Presenting of the main functions of CAD systems. Modeling and creating assemblies. Preparing technical documentations. Presentation of the engineering approach to designing and manufacturing. Presentation of various ways to design and manufacture elements. The application of CAM systems in machine part manufacturing. CAM strategy overview. Practical applications of CAM systems on typical machine elements.	
10	**Computer programming for engineering applications**	**3**	This course introduces students to the fundamental principles of programming for solving engineering problems, using Matlab or C# environment (students can chose the programming environment). It familiarizes students with the process of computational thinking and the translation of real-life engineering problems to computation problems for real problem solving. Further, it describes the basic techniques for systematic software design. It provides fundamental knowledge in basic programming concepts such as program flow control (such as operators, conditions, loops), modular programming (user-defined functions, library functions, file input output operations, memory management, and elementary data structures. By the end of this course, the student will be able to handle the chosen programming language for solving engineering problems. Also students will understand the software fundamentals, techniques, notation, and coding principles.	

11	**Computer methods in aerospace engineering**	**5**	Aviation and space systems are complex products comprised of many subsystems which must meet demanding customer and operational lifecycle value requirements. Traditional systems engineering approaches to air and space systems design have been upended by two trends – increasing complexity and accelerating delivery timelines. Digital mission engineering and model-based systems engineering (MBSE) are essential to these new challenges, enabling a system integrator to redirect work from physical systems to their logical representations. Digitization of the design processes of aviation and space systems integrated with missions requires the use of advanced techniques and computational tools. The main educational goal of the subject is to acquire knowledge and skills in the field of modern methods and computer tools supporting the process of conceptual and initial design of complex aviation and space systems. An additional purpose is to show the strong interdependence between design tools and design processes. One of the course specific objectives is to explain the role of each tool at each product development phase.	
12	**Dynamics of machines**	**3**	LECTURE: 1. Basic definitions. Mechanisms, structure, links, kinematic pairs, kinematic chain, mobility, mechanism, machine, manipulator, robot. 2. Kinematics of selected planar mechanisms: manipulators, gears. 3. Gears, planetary mechanism, differential gear, the gear ratio, cylindrical and conical gear. 4. The dynamics of selected planar mechanisms: manipulators, gears. Reactions in kinematic pairs. Dynamical model of the mechanism movement. 5. Imbalances as a cause of mechanical vibrations. Balancing of masses of mechanisms with link in a rotating motion and complex motion. 6. Dynamics of rotors and turbines. LABORATORY: 1. Imbalance of rotating components on the example of the robot tool – experimental study. 2. Classes with software for machine diagnostics with visualisations, instruction, issues for analysis and tests in English. 3. Computer simulation of test rig consisting of the following components: electric motor, coupling, gearbox, belt transmission, ball bearings, rotor. 4. Simulation and visualization of test rig operations for the following faults: unbalance, bearings faults, looseness, belt faults, gearbox fault, shaft rub, misalignment. 5. Creating your own systems with the following elements: drivers (electric motor, turbine, diesel engine), transmission elements (gearbox, belt/pulley/sheave, coupling, fluid coupling), driven elements (pumps, fans, compressors), rotor, ball bearing. Analysis of frequencies generated by such machines.	Students should have completed “theoretical mechanics” classes

13	**Dynamics of turbomachinery**	**4**	(Lecture): Fundamentals of vibration theory. Description of free and forced vibrations. Problem of mechanical resonance. Frequency-amplitude characteristic. Influence of damping on the amplitude of resonant vibrations. Kinds of unbalancing. Methods used for balancing of rotors. (Laboratory exercise): Experimental modal analysis of the beam realized with the use of modern vibration system. Frequency-amplitude plot determination for the simple beam. Learning of experimental techniques for measure of vibration amplitude with the use of piezoelectric small-size accelerometers. Experimental modal analysis of the turbine blade. Determination of the following parameters: amplitude-frequency characteristic for the turbine blade, resonant frequencies. Learning of measurement methods used in vibration tests: laser scanning vibrometer and optical microscope.	
14	**Engineering metrology**	**4**	The module includes the introduction to geometrical tolerances, surface roughness measurements and the analysis of accuracy of measurements in the field of machine construction. Moreover, the module concerns the use of the coordinate measuring technique during production processes of products. There are presented both the theoretical basis of coordinate measurements and the results of conducted investigations. The theoretical issues concern e.g. the different types of coordinate measuring machines, the general idea of coordinate measurements, the types of associate elements and their influence on measurement accuracy, a filtering process of results of measurements and coordinate measurements of free-form surfaces of products. During the course, students have the opportunity to practice using advanced measuring systems.	
15	**Ecology**	**2**	Definition of ecology. Scope of ecology. Population ecology. Ecosystems ecology. Biomes. Ecological barriers. Characteristics of main air, water and soil pollutants. Greenhouse effect. Demographic problems of the world. The impact of pollution on human health. Sustainable development. Environmental monitoring and education.	
16	**Finite element methods**	**4**	This course introduces finite element method for the analysis of solid problems. Finite element method and solution procedures for linear and nonlinear analyses are presented. Practical exercises using commercial software (Abaqus or Ansys Workbench) are introduced. These applications include finite element analyses, modeling of problems, and interpretation of numerical results. Depending on the students experience the course will be conducted on basic, intermediate or advanced level.	

17	**Flight control systems**	**5**	An objectives of the module are issues related to some aspect of aviation automatic flight control systems. Students are familiarized with mathematical modeling, some simulation techniques employed to investigate dynamic of aircraft. Students on the basics given during face to face lessons are request to solve specific cases as their homework. Individual work makes them familiar with problem statement and solving processes. Moreover all exercises create the consistent chain of engineering subprojects creating full project of sample flight control system. The main topics the module focus on are as follows: -mathematical linear models of airplane motion -pitch and dutch mode dampers -pitch autopilot -roll autopilot -altitude autopilot -heading autopilot -non linear elements of typical flight control systems.	
18	**Flight mechanics I**	**5**	The aim of the course is to relay basic knowledge to students at the area of: aircraft and its environment, aircraft engineering aerodynamic, flight performance at powered and unpowered flight, engine performance, take-off and landing, flight envelopes and cruise performance. The aim of the course is to introduce students to theoretical and practical knowledge in the scope of: - aircraft engineering aerodynamics, - aircraft (glider) unpowered flight, - engine performance (piston, turboprop and turbojet engine), - aircraft performance, flight envelopes, - take-off and landing basics, - cruise performance (range, endurance).	"Flight mechanics I" and "Flight mechanics II" can't be realized during the same semester
19	**Flight mechanics II**	**6**	The aim of the course is to relay basic knowledge to students at the area of aircraft equilibrium, static and dynamic stability and control, both longitudinal and lateral, basics of aircraft simulations on stability, control and response. The aim of the course is to introduce students to theoretical and practical knowledge in the scope of: - aircraft equilibrium, static stability a control – longitudinal and lateral. - description of 3D aircraft motion – general equations of motions, - determination of aerodynamic forces and moments, - longitudinal dynamic stability – basic longitudinal motions, - lateral dynamic stability – basic lateral motions, - basics of modeling and simulation of aircraft maneuvers, - basics of automatic stability and control.	"Flight mechanics I" and "Flight mechanics II" can't be realized during the same semester

20	**Fluid mechanics**	**4**	The course concerns basic ideas of fluid mechanics: mass, momentum, energy conservation principles for fluid flows. Vorticity. Euler Equation. Bernoulli Equation for ideal liquids. Pneumatic/hydraulic devices for velocity and flow-rate measurements: Pitot, Prandtl probes, Venturii nozzle. Navier-Stokes Equations, Capillary flows, Laminar flowmeter. Similarity rules. Reynods-Averaged Navier-Stokes (RANS) Equations. Models of turbulence. Turbulent flow in the pipeline. Linear and local pressure-loss coefficients. Euler Equation for ideal fluid flow machinery. Pumps and hydraulic turbines Pipeline-pump (or fan) systems. Water hammer in pipelines. Cavitation.	
21	**Foundry and welding technology**	**4**	Lecture: 1. hand moulding, molding machines, furnaces for melting metals and alloys, casting technologies, 2. methods welding, gas welding, electric arc welding, gas-shielded welding, weldability of steel Laboratory: 1. Manufactured of sand moulds. Melting furnace induction. Rating casting defects. 2. Gas welding. Calculation of the thermal efficiency of the welding process. Analytical methods for assessing weldability.	
22	**Fundamentals of mechanical engineering**	**5**	(Lecture). Simple load case – torsion. Shear stress definition in the shaft subjected to torsion. Shear stress plot in cross-section of the shaft. Determination of the torsional angle. The small-mass shafts used in aerospace industry. Simple analytical exercise related to torsion with the use of units. Simple load case – bending. Case of bending: pure bending, bending combined with the shear. Determination of bending moment for the beams. Stress distribution in the beams. Designing of the cross-section of the beams. Simple analytical exercise related to bending of beams with the use of units. (Laboratory exercise): Experimental tests of mechanical properties of materials. Hardness test of metals (Brinell, Rockwell and Vickers method). Impact strength of materials. Experimental photoelasticity method use for determination of stress state in the models of structures. Tensometeric technique used for measure of stress and strain of mechanical structures.	

23	**Fundamentals of machine reliability**	**2**	Definition of operating, differences between operational use and service, types of maintenance: daily inspection, routine maintenance, preventive maintenance and others. Types of failures: major and minor failures, catastrophic failure, removable and unremovable failures, chance failure, progressive and severe damages, difference between wear and failure. Classification of friction and lubrication, dry friction, mixed, boundary and fluid lubrication, HD and EHD lubrication. Kinds of wear: abrasive, adhesive, oxidation, delamination, fretting, pitting and others. Reliability and durability, parameters of reliability, calculation of reliability, reliability experimental investigations.	
24	**Fundamentals of machine construction**	**6**	Summary: engineering calculation, engineering materials, factor of safety, safety criterion for fluctuating stress, threaded fasteners: thread mechanics, power screw mechanism, elastic machine components: spring materials, spring systems, rubber elastic components, welded joints: welding processes, weld types, calculation of welded joints, interference fits.	
25	**Gas dynamics**	**3**	The course of gas dynamics concerns high-speed aerodynamics. One-dimensional compressible potential flows: Bernoulli equation for isentropic flows. Critical parameters of flow. De Laval number. De Laval nozzle. Mach cone. Two dimensional isentropic flows: method of characteristics. Normal and oblique shocks. System of shock waves: supersonic diffusors. Measurement techniques for transsonic supersonic flows. Schlieren technique. Supersonic and transonic aerodynamic tunnels. Hipersonic flows around body.	
26	**Heat and mass transfer**	**5**	Principles of heat transfer. Conduction heat transfer. Convection. Heat transfer by radiation. Thermal conductivity. Heat transfer coefficient. Heat conduction through the flat and cylindrical wall. Overall heat transfer coefficient. Steady and unsteady heat conduction. Forced convection during the flow through the channels. Analogy of heat and mass transfer. Limiting current method in measurements of mass and heat transfer coefficients.	
27	**Lean manufacturing**	**4**	Lean concept and rules. Lean tools. Lean management and lean manufacturing systems. Lean concept implementation.	

28	**Logistic management**	**4**	The aim of this course is to present the basic knowledge of supply chain management processes in the companies. The most common processes in supply chain are detailed described: demand planning, sales, transportation planning, distribution planning, replenishment, production planning and purchasing. Different strategy of supply chain management are discussed: physically efficient and market responsive. The consequences of the strategy choice are presented in the areas of: the primary goal, manufacturing focus, inventory strategy, lead time focus, supplier selection, costs and other important parameters. Practical exercises concern: mapping the supply chain, optimization of the business units location, decision making, analyzing the long-time effects of the decisions taking, the concepts for achieve the best return of investment.	
29	**Managament information systems**	**2**	During the management information systems (MIS) subject students learn how businesses use information to improve the company's operations, all because the information isn't worth much if it doesn't serve a purpose. MIS are concentrated at the organization, therefore the main objective of the subject is to prepare students to create more efficient or effective business. The core skills are concentrated at the learning how to solve the problems directly connected with information systems, but the core task - how to determine business requirements for information systems. Students also learn how to manage various information systems so that they best serve the needs of managers, staff and customers. Additionally MIS students learn how to create systems for finding and storing data. Therefore, they learn about computer databases, computer networks, computer security, and lots more.	
30	**Manufacturing machines**	**2**	Manufacturing Machines - the subject of Manufacturing Machines should aim at helping students develop the ability to use industrial technological production machines, peripheral equipment, tools, and control technology equipment in accordance with applicable production technology. Teaching should give students the opportunity to develop knowledge of the different areas where manufacturing machines can be used (turning, milling, drilling, grinding operations), its construction and functions, and also about related methods and technologies.	
31	**Manufacturing process design**	**4**	Fundamental rules for the selection and planning of a manufacturing process. Structure of manufacturing processes (operations, treatments etc.). Selection of semi-finished products. Selection of material type, material form, tolerances, design and shape. Selection of proper tooling. Process design procedures. Manufacturing process design of different mechanical parts. Effect of operational speed on performance and economy. Using materials more economically.	

32	**Material science**	**3**	The subject includes fundamental topics related to aircraft materials characterization and their application in aerospace industry. Students learn about: - main criteria for aircraft materials selection; - structural materials used in aeronautics; - high-temperature creep resisting materials in hot section of aircraft engines; - elementary methods for materials examination: metallography, mechanical properties testing. The main goal is understanding relations between structure, microstructure and properties of engineering materials. Students have opportunity to learn about new trends in fabrication and processing methods of metal products for aerospace industry - i.e. investment casting (including single crystal castings), superplastic forming, thermal barrier coatings production).	
33	**Mechanics of materials**	**5**	(Lecture) External and internal forces – description. Kinds of simple mechanical structures. Definition of stress. Normal and shear stress. Superposition principle. Linear and shape deformation. Tension and compression. Hook's low. Young modulus (modulus of elesticity). Poisson's ratio. Tension plot. Mechanical properties of materials. (Laboratory exercise) Tension test of steel specimen. Kinds of specimens used in experimental tension tests. Determination of the following parameters for steel: force-extension plot, stress-elongation plot, lower and upper yields stress (YS), ultimate tensile strength (UTS). Tension test of aluminum specimen. Division of strain on elastic and plastic. Determination of Young's modulus from tension plot. Determination of the following parameters for aluminum alloy: stress-strain plot, ultimate tensile strength (UTS) apparent elastic limit, yield strength, Young modulus.	
34	**Navigation**	**4**	Earth and geoid model. Position on the Earth, reference systems, circles, latitude and longitude. Great circles and rhumb lines, distances. The vector triangle, wind components. General navigation problems. Topographical maps, scales, charts. Earth magnetism. Direct indicating compass. Remote indicating compass. Gyroscopes. Inertial reference system (IRS), inertial navigation system (INS). Area navigation systems (RNAV). Global navigation satellite systems (GNSS: GPS, GLONASS) and augmentation systems (ABAS, GBAS, SBAS).	

35	**On board systems**	**4**	Functions, principles of operation and integration of measurement and navigation systems: Air Data Module (ADM), Air Data Computer (ADC), Inertial Measurement Unit (IMU), Attitude Heading Reference System (AHRS), Inertial Reference System (IRS), Inertial Navigation System (INS), Global Navigation Satellite System (GNSS), Air Data Inertial Reference Unit (ADIRU), Air Data Inertial Reference System (ADIRS, SAARU). Flight control systems: Fly by wire (FBW) and fly by light- functions, principles of operation, pilot induced oscillations. Full Authority Digital Engine Control (FADEC) systems and their integration with other on board systems. Flight Management System (FMS). Warning systems and detectors: Airborne Collision Avoidance Systems (ACAS), Terrain Awareness and Warning Systems (TAWS) - functions, types of warnings, interpretation of indications, the principle of operation. Synthetic vision systems (SVS), enhanced vision systems (EVS), integration (SEVS), displays. On-board weather radars and passive detectors. Wind shear detectors.	
36	**Operational procedures and flight planning**	**3**	The knowledge given to students is split into two group: a) General operational procedures binding in different types of aviation regulations b) Specific procedures valid for flight planning and preparation process Ad. a) Students are familiarized with the general overview of operational procedures binding at different types of aviation operations. Students are given with similarities and differences related to so called "big" and "small" aviation. Also origins of existing and employed procedures are presented Ad. b) The flight planning is a pilots and dispatchers activity strongly affecting on all kinds of flights. Students get informed what factors should be taken into consideration for proper flight preparation. They get shown with typical documents necessary for flight planning. Some exercises are conducted to plan some virtual flights	
37	**Operational research**	**4**	Linear programming: geometrical method, simplex method, dual problem, special cases. Transportation problem: methods of obtaining feasible solutions: Dantzig's, minimum element and Vogel's approximation methods. Discrete linear programming: integer programming, binary programming, general methods of solutions, special methods: allocation problem, scheduling and other problems. Graph theory, network programming, critical path method. Dynamic programming, practical examples of problems solution. Game theory, queueing theory, modeling and simulation, multi-criterion programming.	

38	**Personnel management**	**4**	The goal of this course is to present the basic knowledge of people management. People are specific resource that could bring the company the real and continuing competitive advantage. The difference between Personnel Management and Human Resource Management is described discussed. People Management as the process is defined. The areas of Personnel Management are detailed presented: manpower planning, recruitment, selection and development. The aim of this course is to clarify the effect of human factors on the results obtained by companies. Practical exercises concern: calculation the number of staff required by a company, match the employees with the job requirements and demands, working stand requirements, assessment methods of human factor influence on processes realised in business.	
39	**Production logistics**	**3**	The purpose of this course is to present the fundamentals of processes realised in production companies. Logistic of the production concerns: research, design, development, manufacture and acceptance of material. Production logistics includes: standardization, quality assurance, transportability, defect analysis, safety standards, specifications and production processes, trials and testing. The main realised process in production companies is the finish goods production but there are also necessary process that leads to get the competitive advantage over other business units. The aim of this course is to explain the influence of all mentioned factors on production results. Practical exercises concern: material recourse planning, production workflow, machine processes scheduling, quality control and product development.	
40	**Production management**	**4**	The objective of the subject “production management” is to produce goods services of right quality and quantity at the right time and right manufacturing cost. Main topics of the subjects: Components of a production system; Aim of production; Classification of production system, Phases of product development; Economic analysis of product development; Productivity; Planning and Managing Production Resources – MRP II / ERP; Just-In-Time approach; Kanban, ABC, Pareto and other analysis.	
41	**Quality management**	**4**	Process approach. Quality management rules. Quality management systems (QMS). Quality standards and requirements. Quality management systems designing and implementation. documentation of the QMS. Quality tools.	

42	**Systems of artificial intelligence**	**2**	The course covers issues related to foundations and interpretation of biological functioning prototypes for an explanation of classical methods and computational techniques in the field of computational intelligence. Information on the latest scientific discoveries in the field of artificial intelligence on the associative method of formation of knowledge, cognitive systems, intelligent inference and construction of interactive artificial intelligence systems are also presented. During the course, the student will be able to know and understand the behavior of biological neurons, and then will be presented their different models used in the calculations and research. This knowledge allows for effective modeling and representation of different data sets in intelligent systems and build useful systems applicants, classifying, recognizing and providing data similar to training data. Student will score knowledge and practical skills in the use of tools, methods and techniques in the field of artificial intelligence.	
43	**Rapid Prototyping Techniques**	**2**	Rapid Prototyping (RP) techniques are widely used in many industries, including the aerospace industry. They allow for the creation of a prototype based on a computer CAD model (Computer Aided Design). Due to the high accuracy of the mapping of the CAD model, rapid prototyping techniques are used in the process of implementing new elements for production. The selection of the appropriate RP technique for a given product or technology case depends on many factors, such as the size of the prototype, the geometric shape accuracy, the quality of the prototype surface, and the type of bench tests to be performed. Conducted classes in the field of RP techniques include characteristics of individual methods, description of manufacturing technology and applied model materials, elaboration of numerical data CAD / STL / RP, engineering service of the apparatus, physical verification of prototypes (surface quality, dimensional accuracy, durability).	

44	**Theoretical mechanics I**	**6**	The object theoretical mechanics 1 is conducted on summer semester. It consists of two pieces: Statics and Kinematics. ***The subject matter of Statics:*** Basic principles, Axioms of statics , Systems of forces acting on a body, Constraints and their reactions, Concurrent force system, moment of a force, Couple of forces, Couple of forces theorem, An arbitrary planar force system, An arbitrary spatial force system, Friction,Trusses, Center of parallel forces with equal directions. ***The subject matter of Kinematics:*** I. KINEMATICS OF A PARTICLE - Radius vector, path of motion, equations of motion .Velocity vector, Equation of path, Acceleration vector of a point, Tangential and normal acceleration, Classification of the motion of a particle II. KINEMATICS OF A SOLID - Translational motion of a solid, Rotational motion of a solid, Plane motion, Resultant motion of a point.	Only summer semester
45	**Theoretical mechanics II**	**4**	The object theoretical mechanics 2 is guided on winter semester as the Dynamics. The subject matter of Dynamics: 1. DYNAMICS OF A PARTICLE - Forces acting at a particle, Differential equations of motion of a particle, Inverse dynamics, Forward dynamics, Differential equations of motion in curvilinear coordinates, D'Alembert's principle. 2. DYNAMICS OF A SYSTEM OF PARTICLES - Introductory remarks, Center of mass of a system, Linear momentum vector of the center of mass, Equation of motion for the center of mass, Impulse of force (impulse momentum),Angular momentum of a system of material particles, Geometric of mass. 3. DYNAMICS OF A SOLID - Translational motion of a solid ,Rotational motion of a solid ,Plane motion of a solid, Dynamics of a system of solids 4. ENERGY METHODS FOR DESCRIBING THE PHENOMENON OF MOTION - Kinetic energy, Work done by the force system 5. ANALYTICAL MECHANICS - Principle of virtual work, Principle of dynamic force analysis equilibrium, General equation of dynamics Lagrange's equations .	Only winter semester

46	**Thermodynamics**	**5**	Basis of phenomenological thermodynamics, basic concepts. Energy. Process. Mechanical and technical work. Heat. Zeroth law of thermodynamics. Specific heat. Conservation of energy principle. First law of thermodynamics for closed and open systems. The law of ideal gas. Caloric form of the equation of ideal gas. Characteristic processes of ideal gas. Calculations of the heat and work. Thermodynamic cycles. Entrophy. Carnot cycle. Second law of thermodynamics. Efficiency thermodynamic cycles. Gas cycles - heat engines. Comparative cycles of internal combustion engines. Comparative cycles of turbine engines.	
47	**Turbomachinery**	**5**	Introduction to turbomachinery – compressors and turbines types presentation and analyse, Explanation of thermodynamic and flow-mechanic laws relevant to turbomachinery. Compressor and turbine work analyse - definition of isentropic and polytrophic efficiency. One dimensional cascade theory Mine line axial turbine and axial compressor flow analyse. Performance map of compressor and turbine presentation.	
48	**UAV based data acquisition**	**2**	The main educational goal of the subject is to acquire knowledge and skills in the field of in-flight tests and data acquisition with the usage Remotely Piloted Aircraft Systems (RPAS). Students will be familiarized with flight test preparation, data acquisition systems, data processing, data presenting and law aspects of this process.	
49	**Vibration Theory**	**5**	LECTURE: Kinematics of Vibration. Basic definitions and formulas, examples. The Vector method of Representing Vibrations. Representation by Complex Numbers. The Single Degree of Freedom System. Undamped Free Vibration. Energy methods, Examples. Undamped Forced Vibration, Beats, Examples. Viscous Damped Free Vibration. Examples. Viscous Damped Forced Vibration. Examples. Theory of Vibration Isolation. Examples. LABORATORY: Simulations. Simulation of longitudinal and torsional vibrations. Simulation of free, damped and forced vibration of discrete systems with one degrees of freedom. Simulation of free and forced vibration of discrete systems with two degrees of freedom. Exercises with a computer system for generating and analyzing vibration signals (including exercises with signals measured on real machines).Measurements and analysis. Systems for vibration: accelerometers, conditioner unit, recorders, exciter, impedance head, software for analysis. Measurements of free vibrations of simple systems: mass with spring. Identification of system parameters: natural frequency, damping factor. Measurements of free and forced vibrations of cantilever beam. Observation of resonance and beat. Observation of vibration modes. Experimental frequency analysis. Spectral analysis of signal (FFT), windowing, creation and interpretation of spectrograms	Students should have completed “theoretical mechanics” classes

50	**Diploma seminar**	**4**	The preparing of diploma thesis	
51	**Final year project**	**15**	Diploma thesis	