RIGA TECHNICAL UNIVERSITY

Faculty of Mechanical Engineering, Transport and Aeronautics

Please note! This is a preliminary list of courses. Changes may occur!

SPRING SEMESTER

BACHELOR COURSES

Code	Course name	CP	ECTS
MTH206	**Engineering Measurements and Experiments**	**2.0**	**3.0**
Experimental investigations in engineering. Methods and technical means for measuring physical and mechanical properties of materials (metals, composites). Measurements of dynamical parameters of mechanisms and structures (vibration, noise, temperature, pressure, flow, matter structure, concentration, force, velocity, acceleration). Types of experiments and plans. Automation of experimental investigations. Identification experiments. Methods for computer analysis and mathematical processing of experimental data.			
MSE304	**Technical Thermodynamics and Heat Exchange**	**3.0**	**4.5**
The subject deals with the problems of thermal processes in nature and technical equipment. Basic topics: thermodynamic systems - characteristics and parameters. Ideal and real gases. Basic laws of thermodynamics. Specific heat, internal energy, enthalpy, entropy, exergy. Thermodynamic processes and cycles. Water and water steam. Humid air. Gas and steam flows. Steam and gas cycles of thermal machines. Refrigerators and heat pumps. Mechanisms and heat transfer. Steady and unsteady heat conduction. Theory of similarity. Convective heat transfer. Thermal and velocity boundary layers. Complex heat transfer. Heat utilizing equipment. Design of heat exchangers.			
MMP215	**Nonlinear Dynamics. Introduction**	**2.0**	**3.0**
Nonlinear dynamics and chaos theory constitute a new multidisciplinary fundamental science for engineers, i.e., it has of a theoretical and practical significance. Nonlinear Dynamics and Chaos ABC: attractors; bifurcations, basins of attraction; solution continuation, chaos and control. Analytical, numerical and experimental research methods. The method of complete bifurcation groups. Rare regular and chaotic phenomena. Multiplicity. Modern software: NLO, Spring, AUTO, Dynamics, Matcont. Applications: technical catastrophes prediction and prevention, control tasks, vibromechanics, electromechanics, cosmology, ecology, medicine.			
MRA320	**Methods and Technology of Process Control**	**3.0**	**4.5**
The essence and types of automation, models of control systems and their classification. Description of process control in different physical systems – mechanical, electrical, thermal, biological etc. Process control and analysis in continuous time and frequency domains. Computer control. Characteristics of discrete time control. Laplace and z-transforms. Process modeling by computers. Electronic control system equipment.			
MRA353	**Electro, Pneumo and Hydro Automatics**	**3.0**	**4.5**
The energy supply and processing elements of electric, pneumatic and hydroautomatic (EPH) systems, information input elements, signal processing and executive elements, the structure and operating principle. Types of equipment operation algorithm. Operational algorithm realization with pneumatic, hydraulic and hard logic electrical elements. Programmable controller (PLC) design and management programmes for the system's algorithm. Computer aided selection, calculation, and system performance modeling of the electric, pneumatic and hydroautomatic system components.			
MSE305	**Hydro- and Gas Dynamics**	**3.0**	**4.5**
The subject contains consideration of properties of liquids and gases, hydrostatic forces, pressure definition. The Fluid Dynamics course is based on motion equations of liquids and gases. Real flows described in terms of border layer equations and turbulence length. Non dimensional methods used for process modeling. Heat losses and flow types are analyzed. Methods of pipe, valve, pump and fan selection. Flow parameters described in nozzles, channels, around the body.			
MTM205	**Engineering Mechanics Problems**	**3.0**	**4.5**
Use of theoretical laws and engineering methods for investigation of real typical systems. Role of chooses of a precision of calculation of model in a case of incomplete model parameter information. Tasks on static and dynamic loading and mechanical stresses. Problems of optimisation in a pneumatics and electromechanical systems.			

MTM341	Numerical Analysis in Engineering Mechanics	2.0	3.0
Analysis of functions and functionals. Extreme values. Optimisation tasks. Numerical analysis of simple analytical expression and experimental data. Analysis and operation of physical and engineering systems by using mathematical techniques. Dynamic analysis of mechanical, hydraulical and thermal systems. Response of these systems to initial conditions, and to transient, steady and random inputs. Stability. Analysis of simple feedback systems.			

MSE201	Heat Study	2.0	3.0
The course "Heat Study" includes topics related to the thermal phenomena in various systems, processes and power plants: Thermodynamic systems and parameters. Basic laws of thermodynamics. Specific heat, internal energy, entropy. Processes and cycles. Water and steam tables and charts. Humid air. Cycles of thermal machines. Steam power equipment. Heat transfer with conduction, convection, radiation. Complex heat transfer. Design methods of heat exchangers. Fuel and combustion theory. Water and steam boilers. Heat utilizing equipment.			

MTH301	Machine Dynamics and Strength	3.0	4.5
Mechanism, machine, classification. Dynamics of machines and mechanisms. Free, forced and parametric oscillations of machine elements. Vibration protection of machines. Friction in machines. Motion irregularity of machine elements. Analysis and calculations of machine elements on reliability, stability, fatigue strength, impact load. Creep and stress relaxation in machine elements. Practical application of vibration effects in engineering (technological vibromachines, vibrodiagnostics of defects, etc).			

MTH302	Methodology and Technique of Design	3.0	4.5
General concept of the main stages of design works. Formation and analysis of the consumer requirements as to the design of the object. Methods for designing the optimal machines and mechanisms. Design methods for increasing the strehgth and stiffness of typical machine elements. Unification and standardization in design works. Application of computer facilities in design works.			

MTH306	Construction of Machines and Mechanisms	3.0	4.5
Analysis and synthesis of mechanisms. Dynamics, models of dynamic calculation of machines and mechanisms. Principles of projection, planing and desing documentation, technology of assembling. Standartization in machine building. Exploitation reliability, life.			

MMP302	Mechanics of Deformable Firm Bodies	3.0	4.5
Deformable body. Stresses. Displacements. Mathematical model. Calculation scheme. Deformation analysis. Stress theory. Mechanical properties. The experimental tasks. The general principles and theorems. Variations method. Ritca method. Bar theory. Plates. Shells. FEM method. A computer program complexes..			

MTH303	Automatization of Calculation of Construction Durability (Basic Course)	3.0	4.5
Structural strength calculations in modern engineering are considered as a component of automated design and analysis systems (CAD/CAE). To master this calculation technique, the student is first given an overview of modelling and numerical methods (discretization of the real structures, matrices, eigenvalue problems, differentiation, integration and systems of linear algebraic equations), then FEM programmes, stress analysis software options, and finally, the student independently performs structural strength calculations with FEM, from simpler cases to advanced tasks including the theory of elasticity.			

Note! Full course description available by clicking on the course code!

MASTER COURSES

Please note! This is a preliminary list of courses. Changes may occur!

(available only to graduate students)

Code	Course name	CP	ECTS
MMP532	**Mechanics of Composite Materials**	**3.0**	**4.5**
Composite materials. Fibers. Matrix materials. Types of composite materials. Calculation of the streses and strains in composite materials. The methods and models of micromechanics of composites. The model of the unidirectional composite. The model of the composite, armed with short fibers. FEM apliccation in the micromechanics of composite materials. Macromechanics of composites. Strength and fracture in composites.			
MMP535	**Fracture Theory**	**4.0**	**6.0**
Griffith ideas on cracks stability conditions. Irvin method. Stress concentration. Stress intensity factor. Fracture toughtness. Energy methods: J-integral, strain energy release rate parameter, R-curve. Damagemechanics. Cracks and debonding in composites. Cyclic loading and de-bonding in composites. Cyclic loading and cracks propagation conditi-ons.			
MSE432	**Thermodynamics and Gas Dynamics**	**3.0**	**4.5**
The subject “Thermodynamics and Gas Dynamics” covers different thermodynamic systems and their characteristics. Energy transition types. Simple and complicated thermodynamic systems.			
MTM409	**Technical System Vibration and Stability**	**4.0**	**6.0**
Composition of motion differential equations for technical systems. Stability of equilibrium. Vibration of linear discreet systems. Parametric vibrations. Stability. Free and forced vibration of rods, shafts, beams. Non-linear cases. Simple vibrations of discs plate and shells. Vibration of rotors. Stability.			
MTH505	**Rotary Machines**	**3.0**	**4.5**
Rotating parts of structures, shafts of energy and transportation machinery parts. A key initiative of the dynamic load factor, rotor disbalance. The dynamic calculation methods are analysed. The rotor balancing methods are considered.			
MMP510	**Experimental Mechanics and Technical Diagnostics**	**4.0**	**6.0**
Reliability. Quality. Definition of testing. Functioning and monitoring diagnostics. Mathematical simulation of objects. Methods of measurement of parameters of testing object. Flaw detection and introscopy. Methods and means of diagnostics. Examples of diagnostic procedures: automobile transport, aircrafts, sea and river transport, railway transport, building engineering structures, technological machines.			
MTH503	**Computer-Aided Analysis of Mechanical Systems of Machines**	**4.0**	**6.0**
Matrix methods in mechanism kinematics and dynamics. The method of constraints for planar kinematic analysis. Revolute, prismatic, gear and cam pairs are considered together with other 2 degrees-of-freedom types of constraints. Formal description of kinematic diagrams. The automatic assembly of the systems of equations for position, velocity and acceleration analysis. Geometry of masses. Forward and inverse tasks of geometric, statistic, kinematic and dynamic analysis. Dynamics of planar systems. Computation of planar generalized forces for external forces and for actuator-spring-damper element. Relations between transfer velocity, angular velocity of rigid body and generalized velocities: analogue matrices. Simple applications of inverse and forward dynamic analysis etc.			
MTH507	**Lifting and Transporting Machines**	**4.0**	**6.0**
Lifting and transporting machines are used to move solids, liquids, powders and other substances, which the engineer must be able to design and advisedly operate. The study course covers various types of lifting and transport machines, the physical and mechanical basics of moving. Construction and transport machinery used in the agricultural, processing (mainly food, wood processing and construction materials production) and service (mainly freight/cargo transit, transport, seaport management) industries are considered as practical examples.			
MTM411	**Shock Theory**	**4.0**	**6.0**
Direct and oblique impact. Impact with rotation. Collision of two bodies. Restitution of impulse. Area of friction. Models with dissipated parameters. Effect of configuration of rod. Hydraulic impact. Impact against elastic beam. Impact in bodies system. Impact in constrained systems.			

Note! Full course description available by clicking on the course code!