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.			
MRA322	**Electronic Equipment of Production Automation**	**3.0**	**4.5**
Functional equipment of discrete electronic automation. Methods and equipment of measuring physical parameters. Evolution of information signals and their processing. Schematics of control systems.			
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.			
MTH303	**Automatization of Calculation of Construction Durability (Basic Course)**	**3.0**	**4.5**
Calculations of design strength as the integral part of computer aided design and analysis (CAD/CAE). An overview of numerical techniques for CAE: matrices, eigenvalue problems, differentiation, integration, linear algebraic equations. Finite element method (FEM). Applying FEM for solution of the elasticity theory problems. Geometric modelling. Discretization of			

	the real structures. Review of general purpose FEM programs. Capabilities of the strength analysis programs. FE libraries, solution methods and commands. Pre-processing, postprocessing and other special capabilities.		

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.		

MTM326	**Mechanical Vibration and Acoustics**	**3.0**	**4.5**
	Free non-damped and damped oscillations. Excited vibrations. Systems with discreet parameters. Vibration of roads and beams. Parametric and auto vibrations. Elements of non-linear vibrations. Propagation of sound. Equations of gas dynamics. Waves propagation, reflection and absorption. Resonators.		

MMP219	**Resistance of Materials (for mechanical engineering) Part 1**	**2.0**	**3.0**
	Basic hypotheses. Mathematik's model. Calculation chart. Forces. Stress.Deformation. Strain.comressions. Strength calculation. Strength theory. Torsion. Bend. The experimental tasks. Flexibility grounds. The general principles and theorems. Displacements. Buckling. Dynamic tasks. Impact at. Long term strength. Plate and shell. FEM Method: Bending Beam and Buckling. System stability.		

MTM201	**Theoretical Mechanics (for mechanical engineers) Part 1**	**2.0**	**3.0**
	Axiomes. Constraints. Simplification and equilibrium of forces systems. Friction of sliding, rotation and turning. Centre of mass. Tensors of inertia. Kinematics and dynamics of particle. Types of motion of a body. Kinematics and dynamics of particle in different frames of reference. General theorems of dynamics. Dynamics of a rigid body. Method of kinetic-static. Balancing. Gyroscope. D'Alembert's principle. Balansing.		

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.		

MAT104	**Structures and Properties of Engineering Materials**	**2.0**	**3.0**
	The role of engineering materials in technology. Types of materials: metals, polymers, ceramics, glass and composites. Structural levels of materials. Interconnection of structure and properties. Mechanical testing. Engineering properties of materials and methods of processing. Recycling. Principles of material selection.		

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

MASTER COURSES

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(available only to graduate students)

Code	Course name	CP	ECTS
MSE535	**Non-Standard Sources of Energy**	**3.0**	**4.5**
The subject gives basic knowledge in matters of non-standard and alternative energy sources, sustainable development theory, legislative acts and strategies on different levels that support and promote use of such energy sources and the modernization of utilization technologies. Huge attention is given to energy sources that have been used already for several centuries – solar, wind, running water (oceans, sees, rivers, tidal and ebb energy), biomass. The potential and the level of the utilization technology of every source is carefully evaluated according to technical, economic, environmental aspects. Emphasis is put on efficiency of energy conversion and total profitability. From the same aspects household and industrial waste, sludge from water treatment plants is considered. Interest is also built towards nuclear energy and hydrogen technologies. All sources are evaluated on the level of EU and the Republic of Latvia development plans.		
MSE541	**Theory of Boundary Layer**	**4.0**	**6.0**
Study course is planned for extended studies of heat and mass transfer, fluid mechanics and aerodynamic theory and practical applications. The main emphasis is on the convective heat exchange and the related phenomena of flow mechanics. Basic topics: Hydrodynamic and thermal boundary layers. Laminar, transient and turbulent flows. Viscosity, compressible and incompressible flows. Differential equations of flow dynamics and heat mass transfer. Boundary layer evaluation and empirical relationships. Analytical and numerical methods for solving equations. Modelling and simulation methods. Empirical methods of heat exchange and flow mechanics.		
MRA253	**Basics of Technical Design**	**2.0**	**3.0**
Marketing demands, fashion and style. The human potential and willingness to use a particular object (ergonomics). Technical aesthetics. Fundamental concepts of design: composition, form, colour. Laws of the design form development in the historic perspective.			
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.			
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.			
MTH507	**Lifting and Transporting Machines**	**4.0**	**6.0**
Ways of transferring/shifting hard objects, liquids, loose and other materials, the physical and mechanical issues of their transfer. Design and exploitation of the machines used in the agriculture, processing industries (mainly food, wood processing, construction materials) and service industries (mainly cargo transit, transport, seaport).			
MTM408	**Optimization Methods**	**4.0**	**6.0**
Extremes of analytic function. Extreme types. Minimum and maximum conditions of analytical function. General optimization problem formulation. Criteria and constraint types. Linear and nonlinear programming, the numerical methods. Gradient method. Local and global optimum. Universal and specialized optimization software. Functionals, the classical methods of functional minimization. Optimal control task standard form. Introduction to optimal control - Pontryagin maximum principle and dynamic programming. Introduction to multiobjective and robust optimization. In this course, students are not creating own optimization software codes, but will use specialized commercial software. Theoretical training target is to create the ability to formulate different optimization problems and use of commercial computer software for problem solution.			
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.			
MMP539	**Vibrotechnology and Vibromachines**	**4.0**	**6.0**
Typical vibtotechnologies and machines. Fundamentals of the system. Nonlinear effects. Optimal design. Vibroisolation tasks. Optimal vibro-protection of machines and constructions. Complexes. Rotor dynamics. Design and calculations.			
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.

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