



FACULTY OF TRANSPORT AND MECHANICAL ENGINEERING

Please note! This is a preliminary list of courses for the study year 2016/2017. Changes may occur!

AUTUMN 2016 BACHELOR COURSES

MAT104 Structures and Properties of Engineering Materials

2.00 CP (3.00 ECTS)

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.

MMM201 Material Science

2.00 CP (3.00 ECTS)

Structure and properties of materials used in engineering and machine building. Forming and transformation of structure. Diagram of condition. Mechanical and technological properties of materials. Theory and technology of thermo treatment. Construction and instrument materials, non-ferrous metals, polymers and composites. Brand and principles of its choice.

MSE201 Heat Study

2.00 CP (3.0 ECTS)

The course ``Basics of Thermal Engineering`` 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.

MTM201 Theoretical Mechanics (for mechanical engineers) Part 1 and Part 2

5.00 CP (7.5 ECTS)

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. Balancing.

MMI101 Fluid Mechanics

2.00 CP (3.0 ECTS)

Subject gives an overview of the basic questions about liquid and gas flows and the most sufficient calculation model choice. Different kinds of flow are viewed and various processes in nature and machine industry fluid circuits are explained.

Subject explains how real fluid circuits work. Mostly pneumatic and hydraulic circuits for movement and force generating are overviewed. Components of these circuits are analysed and properties of those components are viewed. Parameters and calculation principles of hydraulic circuits are shown. Hydraulic circuits for movement generation are analysed.

MMP302 Mechanics of Deformable Firm Bodies

3.00 CP (4.5 ECTS)

Deformable body. Stresses. Displacements. Mathematical model. Calculation scheme. Deformation analysis. Stress theory. Mechanical properties. The experimental tasks. The general principles and theorems. Variations method. Ritz method. Bar theory. Plates. Shells. FEM method. A computer program complexes.

MTH301 Machine Dynamics and Strength

3.00 CP (4.5 ECTS)

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).

MTH303 Automatization of Calculation of Construction Durability (Basic Course)

3.00 CP (4.5 ECTS)

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, post-processing and other special capabilities.

MTM341 Numerical Analysis in Engineering Mechanics

2.00 CP (3.0 ECTS)

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, hydraulic and thermal systems. Response of these systems to initial conditions, and to transient, steady and random inputs. Stability. Analysis of simple feedback systems.

MSE305 Hydro- and Gas Dynamics

3.00 CP (4.5 ECTS)

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 modelling. Heat losses and flow types are analysed. Methods of pipe, valve, pump and fan selection. Flow parameters described in nozzles, channels, around the body.

MRA353 Electro, Pneumo and Hydro automatics

3.00 CP (4.5 ECTS)

The energy supply and processing elements of electric, pneumatic and hydro-automatic (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 modelling of the electric, pneumatic and hydro-automatic system components.

MASTER COURSES

MTM408 Optimization Methods (*graduate*)

4.00 CP (6.0 ECTS)

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.

MMP532 Mechanics of Composite Materials (*graduate*)

3.00 CP (4.5 ECTS)

Composite materials. Fibers. Matrix materials. Types of composite materials. Calculation of the stresses 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 application in the micromechanics of composite materials. Macromechanics of composites. Strength and fracture in composites.

MSE535 Non-Standard Sources of Energy (*graduate*)

3.00 CP (4.5 ECTS)

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, seas, 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.

MTH504 Numerical Analysis for Research of Dynamics of Machines (for Master Students)

4.00 CP (6.0 ECTS)

This is the basic course on the use of numerical methods for the analysis and optimization of machine and mechanism dynamics. In the present field the researchers have to deal with complex problems of numerical mathematics, which demand the proficiency level above the average and is not limited to knowledge of the basic math course.

The main topics of the study subject are:

Ideology of engineering calculation. Preciseness/Exactness, stability, complexity, automation. Analysis of linear systems of frequency and time diapason. Methods of analysis of nonlinear systems. Stability of numerical methods. Hard and badly defined systems. Covered methods. Mechanisms with geometrical sites: differential - algebraical systems. Analysis of machine regulation systems. Simplifying the dynamical models. Programms: MathCad, WorkingModel, MSC ADAMS.

MTH505 Rotary Machines

3.00 CP (4.5 ECTS)

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. Within the framework of the present study subject the students should perform independent work on the following themes: 1st Supercritical speed, calculation; 2nd Differential equations of rotor oscillation with two degrees of freedom; 3rd Dynamic load for the rotor supports.