# RTU Course "Theoretical Mechanics (for mechanical engineers)"

**15325 Teorēt.mehānikas un materiālu pretestības katedra**

*General data*

| | |
|---|---|
| Code | MTM201 |
| Course title | Theoretical Mechanics (for mechanical engineers) |
| Course status in the programme | Compulsory/Courses of Limited Choice |
| Course level | Undergraduate Studies |
| Course type | Academic |
| Field of study | Mechanics, Mechanical Engineering, Machine Building |
| Responsible instructor | Vība Jānis |
| Academic staff | Grāpis Ojārs<br>Grasmanis Bruno<br>Vjaters Ilmārs<br>Novohatska Tatjana<br>Griņevičs Ivans<br>Tipāns Igors |
| Volume of the course: parts and credits points | 2 parts, 5.0 Credit Points, 7.5 ECTS credits |
| Language of instruction | LV, EN, RU |
| Possibility of distance learning | Not planned |
| Maximum auditorium capacity | 25 |
| Maximum number of students per semester | 50 |
| Abstract | 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. |
| Goals and objectives of the course in terms of competences and skills | To acquaint students with the fundamentals of mechanics. In order to achieve this aim the following tasks should be fulfilled:<br>1st Analyse the fundamental relationships of the kinematics, statics and dynamics.<br>2nd Teach students how to solve the task on mechanics applying the computer programs.<br>3rd Improve students' knowledge of physics related to the field of mechanics.<br>4th Teach students the skills required to be proficient in the assessment of the machinery, construction machinery and engineering facilities. |
| Structure and tasks of independent studies | Within the framework of the present course the students should perform independent work on the following themes:<br>1st Solving the static tasks applying the MathCAD program.<br>2nd Modelling the dynamic tasks applying the Working Model.<br>3rd Calculating force and stress applying the Solid Work Program. |
| Recommended literature | O. Kepe J. Vība, Teorētiskā mehānika, Rīga, Zvaigzne,1982.g., 577. lpp;<br>O.Kepe, J.Vība, Teorētiskā mehānika, Dinamika I. Rīga, RTU, 1981., 259.lpp.,<br>O. Kepe J. Vība, Teorētiskā mehānika, Dinamika II., Rīga, RTU, 1996.g., 173. lpp. |
| Course prerequisites | Math. Mechanics. Physics. |

*Course outline*

| Theme | Hours |
|---|---|
| Introduction. | 4 |
| Axioms. | 4 |
| Constraints | 4 |
| Cross force system. | 4 |
| Dispersed forces system in the plane. | 4 |
| Body equilibrium. | 4 |
| Crossing forces in space. | 4 |
| Forces dispersed in space. | 4 |
| Introduction to kinematics and dynamics. | 6 |
| Point kinematics and dynamics. Translation of body movement. | 6 |
| Body rotational kinematics and dynamics. | 6 |
| Plane movement kinetics. | 6 |
| Spherical and the general movement kinetics. | 6 |
| Dalambers principle. | 6 |
| The general dynamic equation. | 6 |
| Mechanical system motion. Special cases. | 6 |

*Learning outcomes and assessment*

| Learning outcomes | Assessment methods |
|---|---|
| At the end of the course students will be able to evaluate the mechanical processes in nature in different forms. | Laboratory work. |
| At the end of the course students will be able to provide examples of object motion and equilibrium. | Practical work/tasks |
| The end of the course will be able to analyze the mechanisms and machinery. | Questions at the end of the lecture. |
| At the end of the course students will be able to distinguish between static and dynamic tasks. | Assessment test |
| At the end of the course students will be able to formulate tasks on the analysis of mechanical objects. | Assessment test |
| At the end of the course students will be able to evaluate the mechanical engineering problems. | Exam |

*Study subject structure*

| Part | CP | ECTS | Hours per Week | | | Tests | | |
|---|---|---|---|---|---|---|---|---|
| | | | Lectures | Practical | Lab. | Test | Exam | Work |
| 1. | 2.0 | 3.0 | 1.0 | 1.0 | 0.0 | | * | |
| 2. | 3.0 | 4.5 | 2.0 | 1.0 | 0.0 | | * | |