# RTU Course "Mechanics of Deformable Firm Bodies"

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

*General data*

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|---|---|
| Code | MMP302 |
| Course title | Mechanics of Deformable Firm Bodies |
| 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 | Gonca Vladimirs |
| Academic staff | Kononova Olga |
| Volume of the course: parts and credits points | 1 part, 3.0 Credit Points, 4.5 ECTS credits |
| Language of instruction | LV, EN, RU |
| Possibility of distance learning | Not planned |
| Abstract | 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. |
| Goals and objectives of the course in terms of competences and skills | The aim is to help students to acquire the skills required to assess and analyze the use of the material in the construction applying the knowledge of mechanics of deformable firm bodies, taking into account the material properties and safety requirements. The task of the study subject is to teach students to assess the strength of the construction. |
| Structure and tasks of independent studies | Studying the main topics of the study subject and preparing for the assessment tests and experiments on the application of the typical materials. Development of the study project consulting recommended literature and attending the tutorials of the lecturer. |
| Recommended literature | 1. E. Lavendelis. Elastības teorija. Rīga. 1986.<br>2. W.B. Bickford. Advanced mechanics of materials. USA. 1998.<br>3. S. Timoshenko. Strength of materials. USA. 1985.<br>4. V. Gonca, S. Gluhihs. Mehānika. Galīgo elementu metode. Rīga.2002.<br>5. J. Sterling Kinney. Indeterminate structural analysis. USA. 1969. |
| Course prerequisites | Mathematics, physics, theoretical mechanics. |

*Course outline*

| Theme | Hours |
|---|---|
| The mechanics of deformable firm body and its models. The basic assumptions. | 2 |
| Stresses. Displacements. Mathematical models and equations for three groups. Boundary conditions. | 2 |
| Tasks and methods of analysis. Elasticity theory equation system solutions. | 6 |
| The main stresses. Strength theory. The potential energy of deformation. | 4 |
| Strength tasks for:  beams, plates, shells. Stress-deformation analysis. | 6 |
| Variations methods. Potential energy. Ritca method. Transfer functions choice. Ritca method accuracy. | 8 |
| Non-linear tasks in mechanic. Ultimate loads method. | 4 |
| Finite element method. The element’s forms. Potential energy. Boundary conditions. | 4 |
| FEM for beams, plate, shell. Stress - deformation analysis. Computer software. | 8 |
| Experimental methods of solid deformable body mechanics. | 4 |

*Learning outcomes and assessment*

| Learning outcomes | Assessment methods |
|---|---|
| Students are able to analyze and write three groups of equations with the boundary conditions of structure. | The exam on a firm deformable body mathematical model. |
| Students are able to analyze and analytically calculate boundary tasks. | Test and examination tasks |
| Students are able to analyze the stresses and strains in the construction of the FEM method and computer program. | Study project: a structural strength calculation with ANSYS software. |

*Study subject structure*

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