

STUDY UNIT DESCRIPTION

Faculty of Mechanics and Machine-Building

CODE

TITLE Theoretical Mechanics

LEVEL 2-nd Year in Modular Underground Course

ECTS CREDITS 6

DEPARTMENT Structural, Theoretical and Applied Mechanics

DESCRIPTION **Statics:** Basic Concepts and Principles of Statics. Constraints and Their Reactions. Concurrent force System. Conditions for the Equilibrium of a Concurrent Force System. Coplanar Force System. Moment of a Force About a Point. A Force Couple. Plane Trusses. Stability of Equilibrium. Arbitrary Force System in Space. Equilibrium Equations for Arbitrary Force System. Centre of Gravity.
Kinematics: Kinematics of a Particle. Methods of Describing Motion. Velocity and Acceleration of a Particle. Some Special Cases of Particle Motion. Kinematics of a Rigid Body. Translational Motion. Rotational Motion. Plane Motion. Resultant Motion of a Particle. Resultant Motion of a Body.
Dynamics: Laws of Dynamics. Differential Equations of Motion for a Particle and Their Integration. Vibration of a Particle. Free Harmonic Motion. Damped Vibration. Damped Forced Vibrations. Resonance. Dynamics of a System. Linear Momentum. Impulse of a Force. Theorem of the Motion of a Center of Mass. Theorem of the Change in Linear Momentum. Angular Momentum. Theorem of the Change in the Angular Momentum. Moment of Inertia of a Body about an Axis. Differential equation of Rotational Motion of a Body. Work Done by a Force. Power. Kinetic Energy. Theorem of the Change in the Kinetic Energy. Potential Energy of a System. Dynamics of Translational and Rotational Motion of a Rigid Body. Compound Pendulum. Dynamics of a Plane Motion of a Rigid Body. D'Alembert's Principle. Analytical Mechanics. Generalized Coordinates. Virtual Displacements of a System. Degrees of Freedom. The Principle of Virtual Work. The General Equation of Dynamics. Generalized Forces. Lagrange's Equations.

Study-unit Aims:

The study of Theoretical Mechanics is to develop the capacity to predict the effects of force and motion in the course of carrying out the creative design function of engineering.

Learning Outcomes:

1. Knowledge & Understanding;

The learner should be able to

Understand the nature of mechanical problem (static, kinematic or dynamic) and choose the respective method of solving;

Distinguish and categorize different types of static and dynamic problems;

Describe the problem using appropriate concepts, principles and theorems of Theoretical Mechanics;

Compose and analyze equations of equilibrium and motion of various mechanical systems;
Know and apply basic theories and principles of Statics, Kinematics and Dynamics;
Understand the direct relevance of problems discussed in Theoretical Mechanics and engineering practice.

2. Skills:

Apply knowledge of Theoretical Mechanics to solve engineering problems;
Select appropriate methods for modeling and analyzing the problems of Statics, Kinematics and Dynamics;
Think in a creative and innovative way in problem solving;
Investigate the failure of mechanical systems, and processes;
Solve engineering problems on the basis of limited and possibly contradicting information;
Create and/or re-design a mechanical process or system, and carry out specialized engineering designs;
Search for information and engage in life-long self-learning discipline.

Main Text/s and supplementary readings:

1. S. Targ. Theoretical Mechanics. A Short Course. -Moscow: Foreign Languages Publishing House, - 421 p.
2. I.V. Meschersky. Collection of Problems in Theoretical Mechanics. – Moscow: The Higher School Publishing House, - 304 p.
3. A. Pytel, J. Kiusalaas. Engineering Mechanics: Statics, Third Edition, Cengage Learning ,200 ,First Stamford Place, Suite 400, Stamford, CT 06902, USA, - 601 p.
4. A. Pytel, J. Kiusalaas. Engineering Mechanics: Dynamics, Third Edition, Cengage Learning ,200 ,First Stamford Place, Suite 400, Stamford, CT 06902, USA, - 673 p.
5. Theoretical Mechanics. Dynamics [Text]: tutorial/ A.M.Dolgov. - D.: National Mining university, 2012. - 160 p.

ADDITIONAL NOTES

Computer Graphics.

Pre-requisite Study-units: Higher Mathematics, Physics, Engineering and

STUDY-UNIT TYPE

Lecture and Tutorial

METHOD OF ASSESSMENT

10% Home assignments; 20% Mid-term test; 20% Oral examination; 50% Final-term examination. 100% Total.