Subject code	Credits
INF2026	4

Title

MULTIMEDIJOS FIZIKA

Title in English

MULTIMEDIA PHYSICS

Subject goal and annotation

Course aims to expose students to the fundamentals of classical mechanics and electricity as well as their applications in producing multimedia content. The sequence of topics covered includes: translational and rotational kinematics and dynamics of particles and rigid bodies, collisions, oscillations, fluid dynamics, electrostatics, steady currents, magnetic field and electromagnetic induction. Each topics of the course is illustrated by developing the presentations on computer algebra system and 3D computer graphics software. Throughout the course, the students get practical experience in application of symbolic and numerical calculations for physic problems analysis and solution, and in creation of small computer simulations and short animations of physical processes.

Prerequisites

Undergraduate courses: mathematical analysis

Relationship between the learning outcomes of the Programme and learning outcomes of the subject

Learning outcomes of the Programme	Learning outcomes of the subject	Criteria for measuring the achievement of learning outcomes
1. Knowledge and understanding of basic mathematics, physics and nature, and its applicability in engineering.	Knowledge and understanding of fundamental mechanics and electricity laws, and its applicability in multimedia techniques.	Student demonstrates the ability to explain provided physical processes/systems and formulate physical problems in mathematical terms. Student demonstrates skills in analysis and solution of physical problems using computer algebra system SAGE: solving kinematic and dynamic equations of motion, solving differential equations describing damped and forced oscillations, calculating electric and magnetic fields, analysing multiloop circuits, calculating the charge motion in electric and magnetic fields, computing transient processes and oscillations in electrical circuits, and visualising the obtained solutions.
4. Knowledge of basic and advanced multimedia theories and applications, ability to apply it.	Ability to select a 3D computer graphics technique involving the physical simulations. Create computer simulations and short animations of physical processes and provide correctness analysis of selected techniques.	Oral student presentation including critical examination and assessment of features and peculiarities of 3D computer graphics techniques. Student demonstrates skills in creating computer simulations and short animations using 3D computer graphics software Blender and applying the techniques and technologies: Modelling, Object Modifiers, Object Constraints, Blender Game, Physics (Rigid Body, Cloth, Wind, Force Fields, Smoke), Particles, Fluid simulation, Material, Textures, Lighting, Cycles, Compositing, Motion Tracking, Video Sequence Editing, Animation.

Subject content

	Lecture topics and contents	Hours
1.	Translational kinematics and dynamics.	2
2.	Forces and force fields. Motion in the gravitational field.	2
3.	Work and energy. Conservation of energy and linear momentum.	2

4.	Motion of system of particles. The centre of mass.	2
5.	Rotation of rigid body. Rotational kinetic energy.	2
6.	Conservation of angular momentum. Moments of inertia. Torque.	2
7.	Collisions.	2
8.	Damped and forced oscillations. Mechanical waves.	2
9.	Fluid and smoke mechanics.	2
10.	Electrostatics.	2
11.	Steady current. Complex circuits.	2
12.	Magnetic field.	2
13.	Electromagnetic induction.	2
14.	Transient processes and oscillations in electrical circuits.	2
15.	Electromagnetic waves. Maxwell's equations.	2
	Total	**30**

Practical work contents

Three groups of practical problems. All problems should be presented and described.
1. Formulation and analytic solution of physical problems.
2. Analysis and solution of physical problems using computer algebra system SAGE.
3. Computer simulations and short animations of physical processes using 3D computer graphics software Blender.

Evaluation of study results

Final written exam (50%), mid-term written exam (17%), and assessments of laboratory (practical) work (33%).

Distribution of subject study hours

Lectures	30
Laboratory work	30
Individual studies (including studies in groups, preparation for the mid-term and final exams)	44
Total	**104**

Recommended literature

No	Authors of publication and title	Number of copies available		
		in the Library of VMU	*in specialized publication collections at VMU*	*in other libraries*
Basic materials				
1.	A.Tamaġauskas et all., Fizika, V.1,Mokslas, 1987.	20		
2.	J. R. Taylor, Classical mechanics, University Science Books, 2005.	1		
3.	A.Tamaġauskas et all., Fizika, V.2,Mokslas, 1989.	20		
Supplementary materials				
1.	Blender 2.6 User Manual	http://wiki.blender.org/index.php/Doc:2.6/Manual		
2.	Sage Tutorial, Release 5.12, October 10, 2013.	http://www.sagemath.org/pdf/en/tutorial/SageTutorial.pdf		

Subject prepared and coordinated by

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