

Study Program: Mechatronics, Doctoral Academic Studies		
Course Title: Physical Phenomena in Mechatronics		
Instructor(s): Milentije D. Luković		
Course Status: Elective		
ECTS Credits: 10		
Prerequisites: None		
Course Objective Acquisition of new knowledge in the field of material contact phenomena, with particular emphasis on fundamental friction processes, dynamic laws governing the relative motion of bodies, applied optics, and software tools for modeling physical phenomena.		
Learning Outcomes Students will be qualified to perform calculations and apply theoretical and practical knowledge in research related to material friction, body motion dynamics, mechatronic devices with LED diodes, and software tools for analytical computation. They will also develop competencies for conducting experimental and research work in laboratory conditions.		
Course Content <i>Theoretical Instruction</i> <ul style="list-style-type: none"> ▪ Understanding friction phenomena between contact surfaces of components made of different materials. Calculation of static and dynamic friction coefficients and determination of their dependence on various parameters such as temperature, material structure, and pressure. ▪ Dynamic analysis of translational and rotational motion of a rigid body – Steiner’s theorem, dynamic equations of motion, laws of conservation of energy and angular momentum in dynamic systems. ▪ Basic concepts of geometrical and wave optics. Properties and sources of light radiation. LED diodes: simulation and optimization of radiation at different wavelengths. ▪ Computational modeling of physical phenomena, tomographic methods, analysis, processing, and simulation using advanced software tools such as <i>Mathematica</i>, <i>Origin</i>, and <i>MatLab</i>. <i>Practical Instruction</i> Preparation of students for independent research of scientific literature and journals in the fields of surface interaction between different materials, dynamic motion analysis, applied optics, and computational simulations in physics. Research work includes continuous review of current scientific literature, design and implementation of experiments, data processing, and writing of a scientific paper within the scope of the doctoral dissertation topic.		
Recommended Literature [1] P. L. Menezes, et. al, <i>Tribology for Scientists and Engineers</i> , Springer, 2013. [2] U. Pettersson, <i>Surfaces Designed for High and Low Friction</i> , Uppsala Univesitet, 2005. [3] D. Chakrabarty, et. al, <i>Classical Mechanics, Chapter 21: Rigid Body Dynamics: Rotation and Translation about a Fixed Axis</i> , Massachusetts Institute of Technology – Boston, 2010. [4] R. Katz, <i>Physics, Chapter 11: Rotational Motion (The Dynamics of a Rigid Body)</i> , University of Nebraska – Lincoln, 1958. [5] E. Fred Shubert, <i>Light-Emitting Diodes</i> , 2 nd ed., Cambridge University Press, 2006, [6] M. Born, E. Wolf, <i>Principles of optics</i> , 7 th ed., Cambridge University Press, 2001, [7] Patrick T. Tam, <i>A Physicist’s Guide to Mathematica</i> , 2nd ed., Academic press, 2008. [8] P. S. Stanimirović, G. V. Milovanović, <i>The MATHEMATICA Software Package and Its Applications</i> , Faculty of Electronic Engineering, Niš, 2002.		
Number of Contact Hours per Week: 7	Lectures: 5	Practical Classes: 2
Teaching Methods Interactive lectures, consultations, study and research activities.		
Assessment (maximum 100 points) Seminar paper (written and defended): 50 Oral examination: 50		