GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical and numerical modelling, PG_00057440		
Field of study	Mechanical Engineering		
Date of commencement of studies	February 2022	Academic year of realisation of subject	2021/2022
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Mechaniki, Wytrzymałości i Sterowania Złożonych Obiektów Technicznych -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Mirosław Gerigk	
	Teachers	mgr inż. Grzegorz Banaszek dr hab. inż. Mirosław Gerigk	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	0.0	0.0	10.0	0.0	30

E-learning hours included: 0.0

Modelowanie matematyczne i numeryczne, PG_00057440 - Moodle ID: 23564
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=23564

Modelowanie matematyczne i numeryczne, P, MiBM II, sem.01 letni 21/22, (PG_00057440) - Moodle ID: 23657
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=23657

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	8.0	62.0	100

Subject objectives

The main aim of the lectures is to teach the students the problems and solutions connected with the mathematical modeling and numerics.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W01] possesses a profound mathematical knowledge useful in the analysis and description of the operation of complex mechanical systems, technological processes and operating properties of machines and devices; is familiar with the main development trends	A student is able to solve hiper-static and non hiper-static problems of strength of the bars, beams and structures of a elsto-plastic character. A student is able to investigate the mechanical characteristics of the structures. A student is able to solve the 2-D and 3-D finite element strength of materials problems. A student is able to solve the strength of materials problems in different fields of technology.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
	[K7_U08] is able to design a procedural equipment or device compliant with the specifications using a design aid system in the form of a design documentation, selecting the appropriate model, performing critical analysis with the proper selection of tools and technologies	The student has the ability to analyze basic issues related to the research, design and operation of unmanned vehicles in the field of theory and solving simple tasks and practical problems. This includes the topics listed in the objective and item sheet. The student is able to work in a group observing all the rules that determine professionalism. The student has the ability to solve basic problems related to the research, design and operation of unmanned vehicles, in terms of assessing the functionality, performance and safety of combined system including unmanned vehicles, including performing simple engineering tasks. The student has the ability to analyze the basic issues related to the research, design and operation of combined systems in the field of theory and solving practical problems, including the selection of methods and tools. This includes the topics listed in the objective and item sheet.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
	[K7_W02] possesses a wide and profound knowledge on continuum mechanics and materials strength within the range of modelling and simulating multi-function mechanical systems	A student is able to consider the phenomena of the loads impact on the elsto-plastic fixed body for the complex state of strength of structure. A student is able to assess the complex state of loads and stress. A student is able to assess the complex states of loads, stress and deformation using the strength hypotheses and enery-based methods. The student has the ability to analyze basic issues related to the strength of materials in the field of theory and solving simple tasks and practical problems. This applies to the topics mentioned in the purpose of the subject. Many of these topics relate to mechanical multi-functional systems.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects

Subject contents	The lectures will concern the following problems: 1. Basic information on the mathematical modelling and numerics including the machine dynamics and mechatronics. 2. Models of mechatronic systems. 3. Modeling of multi-mass systems. 4. Final element method - space (3D) problems. 5. Modal models within the mechatronic systems. 6. Dynamical outputs of the mechatonic systems taking into account the internal factors. 7. Modeling of contro mechatronic systems using the combined finite element method. 8. The selected numeric methods. 9. Dynamics of fundamentals of machines. 10. Dynamics of machine main propulsion system. 11. Self-generated vibrations of the chatter-type during the machine manufacturing process. 12. Additional problems. 13. Applications.
Prerequisites and co-requisites	The student should have basic information in the field of applied physics and mathematics, mathematical analysis, numerical methods, solid state mechanics, including kinetics and dynamics, technical drawing and the basics of programming. The student should have basic information in the field of physics and applied mathematics, mathematical analysis, numerical methods, solid state mechanics, including kinetics and dynamics, construction and construction of complex technical objects, technical drawing and the basics of programming as well as mechatronics and automation. A student is able to solve the ordinary and partial differencial eguations. A student has the selected knowledge in maths: linear algebra, analitical geometry, trygonometry, differencial and integral calculus. A student has the selected knowledge in general mechanics: statics, kinetics, dynamics. A student has the knowledge in strength of materials.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
half term exam, final exam	56.0%	100.0%

Recommended reading	Basic literature	Literatura podstawowa: 1. Cannon R. H.: Dynamika układów fizycznych. Warszawa: WNT 1973. 2. Kaliński K. J.: Nadzorowanie procesów dynamicznych w układach mechanicznych. Gdańsk: Wydawnictwo Politechniki Gdańskiej 2012. 3. Kruszewski J., Wittbrodt E.: Drgania układów mechanicznych w ujęciu komputerowym. Tom I. Zagadnienia liniowe. Warszawa: WNT 1995. 4. Morel J.: Drgania maszyn i diagnostyka ich stanu technicznego. Wyd.: Polskie Towarzystwo Diagnostyki Technicznej 1994. 5. Kaliński K. : Nadzorowanie drgań układów mechanicznych modelowanych dyskretnie. Seria Monografie nr 22. Gdańsk: Wydaw. Polit. Gdańskiej 2001. 6. Marchelek K.: Dynamika obrabiarek. Wyd. 2. Warszawa: WNT 1991. 7. Jemielniak K. : Obróbka skrawaniem. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej 1998.
	Supplementary literature	Literatura uzupełniająca: 1. Gawrysiak M.: Mechatronika i projektowanie mechatroniczne. Białystok: Wyd. Polit. Białostockiej 1997. (jest dostępna w internecie) 2. Borkowski W., Konopka S., Prochowski L.: Dynamika maszyn roboczych. Warszawa: WNT 1996. ISBN 83-204-2051-2. 3. Wrotny L.T.: Zadania z kinematyki i dynamiki maszyn technologicznych i robotów przemysłowych. Warszawa: Oficyna Wydawnicza PW 1998. 4. Grzegożek W., Adamiec-Wójcik I., Wojciech S.: Komputerowe modelowanie dynamiki pojazdów samochodowych. Kraków: Politechnika Krakowska im. T. Kościuszki 2003. 5. Heimann B., Gerth W., Popp K.: Mechatronika. Komponenty metody przykłady. Warszawa: Wyd. Nauk. PWN 2001. 6. Mechatronika. Analiza, projektowanie i badania wybranych elementów i systemów. (Red. K. Kluszczyński). Warszawa: Wydawnictwo PAK 2013.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Modeling of mechatronic systems. 2. Modeling of vibrating systems. 3. Modeling of discrete stacjonary and remote systems. 4. Selected numerical methods. 5. Selected problems of modeling of machines and machine manufactoring.	

Work placement	Not applicable