GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Practical Mechanics, PG_00040982		
Field of study	Transport		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Katedra Wytrzymałości Materiałów -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Karol Daszkiewicz	
	Teachers	dr inż. Karol Daszkiewicz prof. dr hab. inż. Jacek Chróścielewski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	0.0	0.0	30
E-learning hours included: 0.0						

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	5.0	15.0	50

Subject objectives

Understanding of statically indeterminate bar structures and differences in behavior of statically determinate and indeterminate systems. Learning two methods of solving statically indeterminate systems: force method and displacement method. Mastering the basics of Finite Element Method (FEM) and dynamic structure analysis. Studying examples of applications of mechanics in civil engineering and transport.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W02] has broad knowledge of applied mechanics used to understand and describe physical phenomena which occur in transport facilities and means of transport	Student is able to specify the threats to the structures from different types of loads. Student distinguishes types of finite elements and understands modeling of structures by Finite Element Method.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K7_U06] able to integrate knowledge of mathematics, physics, electronics, power engineering, traffic engineering, civil engineering of transport and other fields by applying a system based approach, including non-technology aspects (economics, psychology, sociology, environment, health and safety), able to define the effect these fields have on the development of transport systems, able to use new technical and technological achievements and assess their utility for transport	Student is able to evaluate the type of structure and its specificity in terms of mechanics. Student is able to determinate internal forces and displacements in statically indeterminate bar systems. Student is able to determinate basic parameters of free vibrations for structures with one dynamic degree of freedom.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

Subject contents	Fundamental theorems in the Structural Mechanics - the principle of virtual work, Castigliano's theorems. Determination of displacements in statically determinate systems. A brief description of the Finite Element Method (FEM). Application of FEM script to solving the thin plate in the FreeMat program. Examples of mechanics application in construction and transport. Basics of statically indeterminate systems analysis; determination of static and kinematic degree of indeterminacy. Application of the force method and displacement method to determinating internal forces and displacements in statically indeterminate systems. Basics of dynamic analysis of structures with one dynamic degree of freedom.
Prerequisites and co-requisites	Completing the course of Technical Mechanics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
control tasks	60.0%	50.0%
written exam	60.0%	50.0%

Recommended reading

Basic literature	1. Branicki C.(ed.): Zadania z Mechaniki Budowli, Tom II, Układy statycznie niewyznaczalne, Skrypt PG, 1976. 2. Cywiński Z.: Mechanika budowli w zadaniach Tom II, PWN, 1984 (and further editions). 3. Lubowiecka I., Skowronek M.: Zadania z Mechaniki Budowli. Gdańsk 2000. 4. Przewłócki J., Górski J.: Podstawy mechaniki budowli. Arkady, Warszawa 2006. 5. Rakowski G., Kacprzyk Z.: Metody elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1993. 6. Rucka M., Wilde K.: Dynamika Budowli z przykładami w środowisku MATLAB®. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2014.
Supplementary literature	1. Wilde P., Wizmur M.: Mechanika teoretyczna. PWN Warszawa 1984. 2. Zienkiewicz O.C.: Metoda elementów skończonych. Arkady 1972 (or other editions in foreign languages). 3. Chmielewski T., Zembaty Z.: Podstawy dynamiki budowli. Arkady, 1998. 4. Chróścielewski J., Burzyński S., Daszkiewicz K., Sobczyk B., Witkowski W.: Wprowadzenie do modelowania MES w programie ABAQUS, Wydawnictwo PG, Gdańsk, 2014.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	Explain the Bernoulli's principle of flat sections. Define the principle of virtual work. Determine displacements in a statically determinate frame/truss using the principle of virtual work and technique of "graphical integration". Evaluate the degree of static indeterminacy for the given beam structure. Describe the basic differences between the force method and the displacement method. Determine the internal forces caused by changes in temperature of structure. Determine the internal forces caused by the displacements of supports. Assume the basic determinate system of force method for the following frame/truss system. Calculate the internal forces in a statically indeterminate frame/truss. List the main advantages of the displacement method in a matrix notation. What are the possibilities to improve the accuracy of FEM solution? Divide thin plate into 8-10 CST elements, describe nodes and degrees of freedom. Determine the basic parameters of free vibrations for structures with one dynamic degree of freedom. Write the equation of motion, which parts of equation are zero for free undamped vibrations? Preparation of summary of a scientific article devoted to applications of mechanics. Give examples of the application of mechanics in civil engineering and transport. Describe the most commonly used methods in modeling of structures.
Work placement	Not applicable