GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Engineering Mechanics, PG_00059003		
Field of study	Environmental Engineering		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Obligatory subject group 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	2	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Structural Mechanics -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jarosław Górski	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	20.0	0.0	0.0	0.0	50

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	50	4.0	98.0	152

Subject objectives

The introduction of the main principles of structural statics and the classification of structural systems.
Vector algebra - solving systems of forces.
Presentation of internal forces and the relationships between load and internal forces.
Analysis of beams: simple and continuous beams; frames: simple, non-rectangular, three-hinged.
Analysis of arches. Pressure line-compliant design.
Analysis of planar and spatial trusses.
Analysis of complex and mixed systems; structural gratings and girders.
Presentation of the influence lines, their extreme loading and the envelope of internal forces.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W08] has elementary knowledge of construction: including building materials, their strength, construction mechanics and building physics, moisture migration in buildings, heat transfer through building partitions	The student knows the main concepts and principles of theoretical mechanics. The student has the ability to use vector notation to solve problems of mechanics. The student has a full understanding of bar systems in terms of their statics. The student is able to classify structural systems and systems of forces. The student is able to transform a real engineering object into a series of appropriate static schemes. The student correctly identifies statically determinate and indeterminate structures. The student knows the types of structural interactions. The student knows the relationships between the structure and its loads. The student is aware of the principles of general structural dimensioning.	[SW3] Assessment of knowledge contained in written work and projects
	[K6_W02] has knowledge of physics, including mechanics, thermodynamics, optics, electricity and magnetism, nuclear physics and solid state physics, including knowledge necessary to: 1) understand the basic physical phenomena related to material durability, fluid mechanics and hydraulics, building physics, geodetic measurements ; 2) understanding the principles of operation of basic electrical devices and systems; 3) solving project tasks of the sanitary industry;	Student umie dokonywać obliczeń statycznych układów sił, redukować je. Student umie analizować przypadki szczególne układów sił. Student rozumie równowagę układów statycznych. Student umie obliczać reakcje podporowe i siły wewnętrzne w belkach prostych oraz ma umiejętność sporządzania wykresów sił wewnętrznych bez zapisywania ich równań. Student umie rozwiązywać konstrukcje wieloelementowe: belki ciągłe przegubowe, belki o nieprostokątnej siatce prętów., ramy proste, ramy o nieprostokątnej siatce prętów, układy trójprzegubowe, łuki. Student potrafi formować konstrukcje prętowe w zgodności z ich linią ciśnienia. Student umie rozwiązywać płaskie konstrukcje kratowe metodą równoważenia węzłów i metodą przecięć. Student umie rozwiązywać ruszty, dźwigary załamane, układy złożone i mieszane. Student umie sporządzać linie wpływowe, ekstremalnie je obciążać oraz na ich podstawie rysować obwiednie sił wewnętrznych.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – lecture
The main principles of statics.
Basic concepts of theoretical mechanics.
Algebra of vectors. Forces and moments of forces. The main vector and the main moment of the system of forces.
Reduction and equilibrium of the general system of forces. Reduction of the system of forces relative to a point, resultant of the system of forces.
A force couple.
Special cases of the system of forces: the system of convergent forces, the system of parallel forces, the planar system of forces.
Degrees of freedom. Centers of gravity.
The place of general mechanics in structural analysis. Assumptions made in structural mechanics.
Classification of structural types.
Types of structural interactions.
Boundary (support) conditions of structural systems.
Static determinability. Kinematics of flat bar systems.
Simple beams. Support reactions and internal forces in simple beams.
Differential relationships between load and internal forces. Ability to draw graphs of internal forces without equations.
Continuous pin-joint beams. Indirectly loaded beams.
Beams with a non-rectangular grid of bars.
Simple frames with a rectangular grid of elements. Internal force transmission analysis. Equilibrium in the corners offrames.
Frames with a non-rectangular grid of bars. Three-hinged systems.
Parabolic and circular arches. Pressure lines.
Flat and spatial truss structures. Methods of solving trusses. Solving by nodal equilibrium method and the method of cross-sections.
Complex and mixed systems.
Structural gratings. Girders.
Definition of internal forces in spatial systems.
Influence lines of straight beams and pin-joint continuous beams.
Influence lines of trusses. Influence lines of simple frames, three-hinged frames and complex systems.
Extreme loading of influence lines. Envelopes of bending moments.

Prerequisites and co-requisites

Mathematics
Physics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
practice-oriented test	60.0%	40.0%
exam	60.0%	60.0%

Recommended reading

Basic literature

1. Branicki C., *Structural mechanics in computational examples.* Volume 1. Gdansk University of Technology Publishing House, Gdańsk 1975.
2. Lubowiecka I., Skowronek M., *Structural mechanics in computational examples.* Gdansk University of Technology Publishing House, Gdańsk 2000.
3. Górski J., Przewłócki J., Skowronek M., Winkelmann K., *Mechanics and Strength of Materials.* Gdansk University of Technology Publishing House, Gdańsk 2015.

Supplementary literature

1. Cywiński Z., *Structural mechanics in computational examples.* Volume I. PWN Warsaw 1999.
2. Konopińska-Zmysłowska V., Mleczek A., Oziębło M., Tomaszewska A., *Selected problems of mechanics of beam systems. A set of calculational examples for Students of Environmental Engineering.* Gdansk University of Technology Publishing House, Gdańsk 2016
3. Niezgodziński T., *Theoretical mechanics,* WN PWN Warsaw 2002.
4. Nizioł J., *Methodology of solving problems in mechanics,* WNT Warsaw 2002.
5. Nowacki W., *Structural mechanics.* Volume 1, PWN Warsaw 1974.
6. Wilde P., Wizmur M., *Theoretical mechanics.* PWN Warsaw 1984.

eResources addresses

Example issues/ example questions/ tasks being completed	Calculate the values of internal forces in three vertical lattice bars supporting a rigid plane stress structure/ plate. Determine the diagrams of internal forces (N - normal, V - shear, M - bending moments) in a free-supported beam, subjected to a given load. Determine the diagrams of internal forces (V - shear, M - bending moments) in a continuous pin-joint beam, subjected to a given load. Determine the diagrams of internal forces (N - normal, V - shear, M - bending moments) in a frame with a rectangular mesh of elements, subjected to a given load. Determine the diagrams of internal forces (N - normal, V - shear, M - bending moments) in a frame with a non-rectangular mesh of elements, subjected to a given load. Determine the diagrams of internal forces (N - normal, V - shear, M - bending moments) in a three-hinged frame with a rectangular mesh of elements, subjected to a given load. Determine graphs and values of internal forces in the frame-truss system: N - normal, V - shear, M - bending moments in the frame elements, S - axial forces in the truss elements. Determine the values of axial forces (S) in all elements of a simply supported truss subjected to a given load. Draw the pressure line of the system under the specified load between the three given points (construction joints - A, B and C). Determine the key elevations of the optimal structure (pressure line). Draw the diagrams of internal forces for the specified structural grating (V - shear force, M - bending moments). Draw the diagrams of internal forces for the specified girder (V - shear force, M -bending moments, Ms - torsional moments). For the given simply supported beam, draw the vertical reactions (Ra, Rb) influence lines and the internal force influence lines(Talfa, Malfa in the alpha section of the beam). Basing on the influence lines, set the load of a technical vehicle with a given axle weight so that Malfa bending moment reaches its extreme values. Determine the value of the moment.
Practical activites within the subject	Not applicable

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