GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	NUMERICAL ANALYSIS OF METAL STRUCTURES, PG_00041293		
Field of study	Civil Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Metal Structures -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Iwicki	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	0.0	0.0	45

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	45	5.0	25.0	75

Subject objectives

The aim of the course is to present the current problems of numerical analyses of metal structures with special emphasis on the problems of stability. The computer programs will be used for numerical analysis of metal structures for first and second order static analysis, stability analysis and design. The student is to learn the applications of programs for numerical analysis of metal structures. The student is able to use the programs and perform a calculation of bar and shell structures.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U03] can perform classic statical and dynamical analysis of rod structures stability (trusses, frames and ties), both statically determined and undetermined as well as surface structures (plates, membranes and shells)	Student can perform linear buckling analysis of a beam, frame and shell structure.	[SU1] Assessment of task fulfilment
[K7_W02] knows principles of analysis, design and dimensioning of complex constructions and its elements	Student can prepare a numerical model of a 3D steel frame structure using ARSA software and perform static analysis and member resistance calculations.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W03] has knowledge of Continuum Mechanics, knows rules of static analysis, stability and dynamics of complex rod, shell and volume structures, both in linear and basic nonlinear regime	The student is able to present different types of equilibrium paths and illustrate them on examples of metal structures.	[SW1] Assessment of factual knowledge
[K7_W04] has knowledge on advanced strength of materials, modeling and optimisation of materials and constructions; has knowledge of fundamentals of Finite Element Method and general nonlinear analysis of engineering constructions and systems	The student has knowledge of current computer programs used for static analysis and structural stability.	[SW1] Assessment of factual knowledge

Subject contents

Lecture:Selected examples of modelling of engineering structures such as steel buildings, silos, bridge structure or roof of the church. Selected elements of matrix analysis of bar structures. Modification and condensation of the stiffness matrix. Geometric matrix and its application to the problems of stability and first and second order statics analysis of metal structures. Effect of elastic supports. Basis for nonlinear static analysis. The use of structural analysis software for structural analysis, stability and design of metal structures. Stability analysis of plates, thin-walled bars and shells (silo structure). Current research issues concerning numerical analyses of metal structures.Laboratory:

- Modeling of the 2D rod systems and shell structures in the aspect of stability.
- Calculations of critical forces and critical bending moments using ARSA software.
- Static analysis of the 3D numerical model of a steel hall building with calculations of selected member resistance.

Prerequisites and co-requisites

- Structural Mechanics
- Strength of Materials
- Metal structures.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
One test	60.0%	60.0%
Team project	60.0%	40.0%

Recommended reading

Basic literature	1. Timoshenko S. P., Gere J. M.: Theory of Elastic Stability. Arkady, 1963 2. Waszczyszyn Z., Cichoń C., Radwańska M.: Stability of structures by finite element methods. Elsevier, Amsterdam,1994 3. Weiss G., Giżejowski M., Stability of metal structures - bar elements. Warszawa Arkady 1991. 4. Rakowski (red.): Structural mechanics with elements of computer methods, Arkady, Warszawa, 1991. 5. M. Piekarczyk: Selected design problems of thin-walled steel members and connections in building structures, Cracow 2018 6. Falborski T., Knabe W., Perliński A., Urbańska-Galewska E.: Wybrane zagadnienia projektowania stalowych konstrukcji prętowych z wykorzystaniem programu Autodesk Robot Structural Analysis, Wydawnictwo PG, 2019. 7. Marcinowski J.: Stateczność konstrukcji sprężystych, Dolnośląskie Wydawnictwo Edukacyjne, 2017. 8. Michałowski T., Piekarczyk M.: Selected issues of special steel structures. Chimneys, silos, tanks, Wydawnictwo Politechniki Krakowskiej, 2019.
Supplementary literature	no items
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

Lecture:Calculation of critical loads on thin-walled silo columns taking into account the elastic foundation made of corrugated sheet.Laboratory:

- Critical force calculations of a circular arch made of RK300x300x10 subjected to uniformly distributed load; span L= 18 m, height H= 6 m.
- Critical bending moment calculations of a cantilever beam made of IPE200 subjected to point load at the end; span L=3 m.

Work placement

Not applicable

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