GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Structural Analysis II, PG_00044307 | | |
| Field of study | Civil Engineering | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | 2024/2025 |
| Education level | second-cycle studies | Subject group | Obligatory subject group in the field of study<br>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 | 7.0 |
| Learning profile | general academic profile | Assessment form | exam |
| Conducting unit | Structural Mechanics Department -> Faculty of Civil and Environmental Engineering | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Łukasz Smakosz | |
| | Teachers | | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 25.0 | 25.0 | 0.0 | 0.0 | 0.0 | 50 |

E-learning hours included: 0.0

Adresy na platformie eNauczanie:

**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 | 7.0 | 118.0 | 175 |

**Subject objectives**

Consolidation of knowledge in the field of structural mechanics.Introduction of methods for solving static problems of beam systems in matrix notation.Presentation of problems of correct modeling of engineering 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) | The student performs an engineering structure analysis with the use of matrix methods | [SU1] Assessment of task fulfilment |
| [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 knows the basics of matrix methods of structure analysis, with the ability to choose the right method for a given problem | [SW1] Assessment of factual knowledge |
| [K7_W03] knows basics 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 knows the algorithm of static analysis of complex beam structures using computer methods | [SW1] Assessment of factual knowledge |

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|---|---|
| Subject contents | Matrix displacement method. Determination of stiffness and flexibility matrix of structural systems. Discretization of a structural system. Stiffness matrices of beam and frame elements (truss, beam, frame element). Condensation and modification of the stiffness matrix. Block and universal aggregation. Fundamentals of the finite element method for bar systems. Basic problems of structural modeling and simplifications related to assuming static schemes of actual structures. |
| Prerequisites and co-requisites | Knowledge of structural mechanics in a classical approach for statically determinate and indeterminate beam systems.Knowledge in the strength of materials field. |

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| exam | 60.0% | 100.0% |

**Recommended reading**

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|---|---|
| Basic literature | 1. M. Guminiak, J. Rakowski: Mechanika konstrukcji prętowych w ujęciu macierzowym. Wydawnictwo Politechniki Poznańskiej, 2012<br>2. C. Branicki, M. Wizmur : Metody macierzowe w mechanice budowli i dynamika budowli. Skrypt Politechniki Gdańskiej, 1984<br>3. C. Branicki : Komputerowa analiza konstrukcji prętowych Bezpośrednią Metodą Przemieszczeń. Politechnika Gdańska, 1999.<br>4. G. Rakowski (red.) : Mechanika Budowli z elementami ujęcia komputerowego, Arkady, Warszawa, 1991.<br>5. M.K. Jasina : Mechanika Budowli – Macierzowa analiza konstrukcji, statyka, Materiały dydaktyczne KMB, Gdańsk, 2004 |
| Supplementary literature | 1. T. Chmielewski, H. Nowak: Wspomaganie komputerowe „CAD CAM”, Opole.<br>2. G. Rakowski, Z. Kacprzyk „Metoda elementów skończonych w analizie konstrukcji” Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1993.<br>3. O.C. Zienkiewicz „Metoda elementów skończonych” Arkady, Warszawa 1972. |
| eResources addresses | |

**Example issues/ example questions/ tasks being completed**

1. Divide a given static system into elements. Describe degrees of freedom.
2. Determine the stiffness and flexibility matrix of a p[lanar beam system.
3. What is a beam element stiffness matrix? What is the physical interpretation of its individual columns?
4. Provide an algorithm for the construction of a global system of equations in the problems of statics.

**Work placement**

Not applicable