COURSE DESCRIPTION CARD - SYLLABUS

Course name

Frames and supporting constructions part 2

Course

Field of study	Year/Semester
Construction and Exploatation of Means of Transport	4/7
Area of study (specialization)	Profile of study
Machines	general academic
Level of study	Course offered in
First-cycle studies	Polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
0	0	0
Tutorials	Projects/seminars	
15	0	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Faculty of Civil and Transport Engineering

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Responsible for the course/lecturer:

Prerequisites

Knowledge: Theoretical and practical information in the field of construction of supporting structures of working machines, construction of currently used mechanical connections, basic methods of computer aided design of frame systems. Knowledge of the principles of structural mechanics (statics, stability and dynamics).

Skills: The ability to design frame structures and load-bearing structures in traditional engineering terms. Basic practice in handling computational systems based on the finite element method, allowing for the development and numerical solution of spatial computational models of supporting structures, taking into account the actual connections and contacts.

Social competences: The ability to independently formulate problems of mechanical analysis of a structure and to resolve related dilemmas. The ability to correctly plan and timely perform activities in the implementation of computational projects.

Course objective

Provide students with knowledge on: theoretical foundations and the implementation of numerical computational methods intended for modeling load-bearing systems of working machines and their static, stability, dynamic analysis in the linear and non-linear range, as well as the principles of inference regarding the strength and durability of structures.

Course-related learning outcomes

Knowledge

1. Knows the theoretical foundations and the basics of the implementation of numerical computational methods for modeling basic load-bearing structures in machines

2. Knows the finite element method and models used in the field of structural mechanics

3. Knows the basics and computer computational practice of static, stability and dynamic analysis in the linear range

Skills

1. Is able to use the finite element method to design immediate and fatigue strength

2. Is able to define the boundary and initial conditions and define loads when using computer calculation methods in designing spatial load-bearing systems of working machines

3. Is able to reflect the mechanics of basic connections and contacts in FEM computational models

Social competences

1. Is aware of the importance of using computer methods for the optimization of vehicle design processes

2. Understands the need for continuous updating of software supporting design processes

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written credit on the lecture material and credit exercises based on computational analyzes of subassemblies or structural elements found in typical working machines.

Programme content

The importance of using calculation methods in the design of frames and load-bearing structures. Continuous and discrete issues. The transformation of a continuous problem into a discrete problem through discretization and approximation. Calculation methods: finite difference method (MRS), finite element method (FEM), boundary element method (MEB) and finite volume method (MOS).

Static calculations using FEM. Review of finite elements: volumetric, surface and linear. The course of static analysis. Methods for solving systems of linear equations: direct and iterative.

Stability calculations using FEM. The idea of bifurcation. Initial stability. Generalized eigenstability problem. The course of bifurcation analysis.

Dynamic calculations using FEM. Equation of dynamics at the discrete level.

Teaching methods

Performing a model of the load-bearing structure and carrying out strength calculations using the available FEM system.

Bibliography

Basic

1. Kleiber M., Wprowadzenie do metody elementów skończonych, Poznań, WPP 1984

2. Kleiber M., Numeryczna analiza statycznych i dynamicznych zagadnień stateczności konstrukcji, Poznań, WPP 1987

3. Łodygowski T., Kąkol W., Metoda elementów skończonych w wybranych zagadnieniach mechaniki konstrukcji inżynierskich, Poznań, WPP 1994

4. Praca zbiorowa pod red. Zabrodzkiego J.: Grafika komputerowa. Metody i narzędzia. WN-T, Warszawa, 1994.

5. Kruszewski J., Sawiak S., WittbrodtL.: Wspomaganie komputerowe CAD/CAM. Metoda sztywnych elementów skończonych w dynamice konstrukcji. WN-T, Warszawa, 1999.

6. Perkowski P.: Technika symulacji cyfrowej. WN-T, Warszawa, 1980.

Additional

1. Zienkiewicz O.C.: Metoda elementówskończonych. Arkady, Warszawa, 1972.

2. Weiss S., Giżejowski M.: Stateczność konstrukcji metalowych. Układy prętów. Arkady, Warszawa 1991.

3. Biegus A.: Nośność graniczna stalowych konstrukcji prętowych. Wydawnictwo Naukowe PWN. Warszawa-Wrocław 1997.

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for tutorials, preparation for exam) [1]	60	2,0

[1] delete or add other activities as appropriate