COURSE DESCRIPTION CARD - SYLLABUS

Course name
Metal structures with BIM [S2Bud1-KB>KMzeBIM]

Course

Field of study
Civil Engineering

Year/Semester
1/1

Area of study (specialization)
Structural Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
30

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

KNOWLEDGE: Basic knowledge in the field of mechanics of structures in the field of rod systems and strength of materials as well as information presented in the subject of Metal Structures of the 1st degree studies. SKILLS: The ability to determine stresses. The ability to design basic elements of metal structures by the limit state method as well as welded and bolted connections. The ability to calculate cross-sectional forces in statically determinate and indeterminate systems. SOCIAL COMPETENCE: Awareness of the need to improve professional and personal competences. Understanding the need to provide the society with knowledge about technical and technological processes in construction in a commonly understood manner.

Course objective

The aim of the conducted classes is to introduce the basic methods of designing overhead crane beams and frame buildings, as well as the use and interpretation of results from engineering programs.

Course-related learning outcomes

Knowledge
1. Know in detail the principles of analysing, constructing and dimensioning elements and connections in

selected building structures.
2. Know key issues of continuous medium mechanics; principles of analysing the issues of statics, stability and dynamics.
3. Know in detail the rules of design, construction and operation of selected building units.
Skills
1. Can prepare an evaluation and statement of strengths influencing both simple and complex building units.
2. Can design elements and connections in complex building units, working both individually and in a team.
3. Can perform a classical static and dynamic analysis and stability analysis of statically determinate and non-determinate bar structures (trusses, frames and strands); as well as surface construction (discs, plates, membranes and shells).
4. Are able to correctly define a computational model and carry out an advanced linear analysis of complex building units, their elements and connections; are able to apply basic nonlinear computational techniques together with a critical evaluation of numerical analysis results.
5. Can dimension complex construction details in selected building units.
Social competences
1. Take responsibility for the reliability of working results and their interpretation.
2. Can realise that it is necessary to improve professional and personal competence; are ready to critically evaluate the knowledge and received content.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - test checks the last class. Exercise design - execution of the project and its oral defense.
Laboratory: completion of all laboratory tasks and preparation report
Grading scale:
5.0 - the student obtained more than 90% of the points in the colloquium or defense of the project,
4.5 - the student obtained from 80% to 90% of the points in the colloquium or project defense,
4.0 - the student obtained from 70% to 80% of the points in the colloquium or project defense,
3.5 - the student obtained from 60% to 70% of the points in the colloquium or project defense,
3.0 - the student obtained from 50% to 60% of the points in the colloquium or project defense,
2.0 - the student obtained less than 50% of the points from the colloquium or project defense
Presentation of the results of the tasks solved during the laboratories

Programme content

The course covers advanced aspects of designing steel hall structures, including cladding systems, runway and underslung crane beams, concentrated crane loads, spatial interaction of structural members, modelling of transverse systems, and the design and sizing of connections and eccentrically compressed columns, taking into account their flexibility and spatial stability. During the laboratory classes, students learn advanced modelling of steel frame structures using BIM tools and elements with 6 and 7 degrees of freedom (6DoF and 7DoF), applying the acquired knowledge in the design of a crane runway beam.

Course topics

Cladding systems, design of a overhead cranes, numerical models of a frames, 3D models of hall - cooperation between elements, eave and foot connections, designing of connections with respect to their flexibility, designing of columns subjected to eccentric commpression, 3D stabiity of hals (bracing systems).
Project desing project of a overhead beam
Laboratory exercises cover the aspect of the designing of the rod steel structures using civil engineering applications (element of the BIM modelling).
The scope of the laboratories assumes the presentation of the 6DoF and 7DoF finite elements in the context of the dimensioning of the structural steel elements. Various global analyses (Eurocode 3) will be presented on the example of the overhead crane girder. The methods of introduction of the standard imperfection (EC3) by means of linear buckling analysis will also be discussed.

Teaching methods

Lecture: informative lecture, probem lecture, demonstration
Projects: project and demonstration method,

Laboratory: demonstration method and numerical experiment

Bibliography

1. Biegus A., (2008), Stalowe budynki halowe, Wydawnictwo Arkady, Warszawa, s. 342
2. Bródka J., Kozłowski A., (2009), Projektowanie i obliczanie połączeń i węzłów konstrukcji stalowych. Część 1. Polskie Wydawnictwo Techniczne, s. 600
3. Bródka J., Kozłowski A., (2009), Projektowanie i obliczanie połączeń i węzłów konstrukcji stalowych. Część 2. Polskie Wydawnictwo Techniczne, s. 843
4. Giżejowski, Ziółko J., (2010), Budownictwo ogólne. Tom 5. stalowe konstrukcje budynków projektowane wg eurokodów z przykładami obliczeń, Wydawnictwo Arkady, Warszawa, s. 1085
5. Kurzawa Z., (2011), Stalowe konstrukcje prętowe. Część 1. Hale przemysłowe oraz obiekty użyteczności publicznej, Wydawnictwo Politechniki Poznańskiej, Poznań, s. 368
6. Rykaluk K., (2006), Konstrukcje stalowe. Podstawy i elementy, Dolnośląskie Wydawnictwo Edukacyjne, Wrocław, s. 431
1. PN-EN 1990 Eurokod: Podstawy projektowania konstrukcji
2. PN-EN 1991 Eurokod 1: Oddziaływania na konstrukcje
3. PN-EN 1993 Eurokod 3: Projektowanie konstrukcji stalowych

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	75	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00