

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: Thin-walled steel structures

Academic year: 2019/2020 Code: GBUD-2-116-GE-s ECTS credits: 2

Faculty of: Mining and Geoengineering

Field of study: Civil Engineering Specialty: Geotechnical Engineering and Underground Construction

Study level: Second-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 1

Course homepage: —

Responsible teacher: dr inż. Pięciorak Edyta (epiec@agh.edu.pl)

Module summary

Design of thin wall elements.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	The student is responsible for the accuracy of the results of their work.	BUD2A_K03	Execution of a project
M_K002	The student is aware of the need for sustainable development in the field of thin-walled steel structures.	BUD2A_K01	Execution of a project, Participation in a discussion, Activity during classes
Skills: he can			
M_U001	The student knows how to design thin-walled steel engineering structures.	BUD2A_U01	Execution of a project
M_U002	The student can choose the tools (analytical or numerical) to solve engineering problems in the field of thin-walled steel structures.	BUD2A_U03	Execution of a project
Knowledge: he knows and understands			
M_W001	The student has knowledge of the design and dimensioning of thin-walled steel structures.	BUD2A_W03	Execution of a project, Participation in a discussion, Activity during classes

M_W002	The student is familiar with the classifications and scope of computer software supporting the analysis and design of thin-walled steel structures.	BUD2A_W01	Execution of a project, Participation in a discussion
M_W003	The student has an extensive knowledge of the theoretical basis of the analysis and optimization of thin-walled steel structures.	BUD2A_W04, BUD2A_W06	Execution of a project, Participation in a discussion
M_W004	The student knows the standards and guidelines for the design of thin-walled steel structures.	BUD2A_W05	Execution of a project, Participation in a discussion

Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
30	15	0	0	15	0	0	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	The student is responsible for the accuracy of the results of their work.	-	-	-	+	-	-	-	-	-	-	-
M_K002	The student is aware of the need for sustainable development in the field of thin-walled steel structures.	+	-	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	The student knows how to design thin-walled steel engineering structures.	-	-	-	+	-	-	-	-	-	-	-
M_U002	The student can choose the tools (analytical or numerical) to solve engineering problems in the field of thin-walled steel structures.	-	-	-	+	-	-	-	-	-	-	-
Knowledge: he knows and understands												

M_W001	The student has knowledge of the design and dimensioning of thin-walled steel structures.	+	-	-	+	-	-	-	-	-	-	-
M_W002	The student is familiar with the classifications and scope of computer software supporting the analysis and design of thin-walled steel structures.	+	-	-	+	-	-	-	-	-	-	-
M_W003	The student has an extensive knowledge of the theoretical basis of the analysis and optimization of thin-walled steel structures.	+	-	-	+	-	-	-	-	-	-	-
M_W004	The student knows the standards and guidelines for the design of thin-walled steel structures.	+	-	-	+	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	5 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	15 h
Realization of independently performed tasks	5 h
Contact hours	1 h
Summary student workload	56 h
Module ECTS credits	2 ECTS

Additional information

Module content

Lectures

The issues of general and local stability of steel bar and steel surface structures. The concept of thin-walled construction.

The use of supercritical reserve capacity in the design of steel structures. Designing girders according to PN-EN 1993-1-5.

The use of SIN girders and with a web of the trapezoidal sheets in modern building solutions.

The use of cold sheet bent sections. Issues of work in light housing elements. Calculation methods. Reinforcing thin-walled structures by gluing.

Project classes

Design 1: Static calculations and dimensioning of plate girder in class 4

Design 2: Designing trapezoidal sheet

Teaching methods and techniques:

Lectures: Treści prezentowane na wykładzie są przekazywane w formie prezentacji multimedialnej w połączeniu z klasycznym wykładem tablicowym wzbogaconymi o pokazy odnoszące się do prezentowanych zagadnień.

Project classes: Studenci wykonują zadany projekt samodzielnie, bez większej ingerencji prowadzącego. Ma to wykształcić poczucie odpowiedzialności za pracę w grupie oraz odpowiedzialności za podejmowane decyzje.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Grade in design classes: Average in projects 1 and 2.

Grade for the project: 0.5 mark for the project + 0.5 mark for defending it. Negative grade for the project or its defense leads to a negative assessment of the project.

The primary date for obtaining credit for project classes is the end of classes in a given semester (last class).

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: No

- Participation rules in classes: Studenci uczestniczą w zajęciach poznając kolejne treści nauczania zgodnie z sylabusem przedmiotu. Studenci winni na bieżąco zadawać pytania i wyjaśniać wątpliwości. Rejestracja audiowizualna wykładu wymaga zgody prowadzącego.

Project classes:

- Attendance is mandatory: Yes

- Participation rules in classes: Studenci wykonują prace praktyczne mające na celu uzyskanie kompetencji zakładanych przez sylabus. Ocenie podlega sposób wykonania projektu oraz efekt końcowy.

Method of calculating the final grade

Grade in design classes: Average in projects 1 and 2.

Grade for the project: 0.5 mark for the project + 0.5 mark for defending it. Negative grade for the project or its defense leads to a negative assessment of the project.

Grade for lectures: Attendance at all lectures - 5.0. Each absence lowers the grade by half a point.

Final mark: $0.4 \times \text{grade for lectures} + 0.6 \times \text{grade for project classes}$.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

Should the student fail project classes within the primary deadline, it is possible to pass during the lecturer consultations in the first exam session.

For excused absences, project classes can be made up for with other groups, provided the lecturer agrees and under the condition that the class is on the same topic.

Catching up on material related to justifiable absences (when it is impossible to catch up with other groups) should be done within 2 weeks and presented during consultation with a lecturer.

Prerequisites and additional requirements

The primary date for obtaining credit for project classes is the end of classes in a given semester (last class).

Should the student fail project classes within the primary deadline, it is possible to pass during the lecturer consultations in the first exam session.

For excused absences, project classes can be made up for with other groups, provided the lecturer agrees and under the condition that the class is on the same topic.

Catching up on material related to justifiable absences (when it is impossible to catch up with other

groups) should be done within 2 weeks and presented during consultation with a lecturer. Project classes are mandatory.

Recommended literature and teaching resources

1. Davies J. M., Jiang C.: Design Procedures of Profiled Metal Sheeting and Decking. Thin - Walled Structures. Vol 27, No.1, 1997.
2. Hancock G. J., Kwon Y. B., Bernard E. S.: Strength Design Curves for Thin - Walled Sections Undergoing Distortional Buckling. Journal of Constructional Steel Research. Vol. 31. 1994.
3. Hancock G. J., Trahair N. S.: Lateral Buckling of Roof Purlins with Diaphragm Restraints. Civil Engineering Transactions. IE Australia. Vol. CE21. No 1/1979.
4. Hancock G. J.: Design of Cold - Formed Steel Structures. Australian Institute of Steel Construction. Sydney 1998.
5. Pasternak H.: Cold - Formed Members and Sheeting. ESDP, Stahlbau - Petersen.
6. Pasternak H.: Cold - Formed Members and Sheeting. Tempus JEP - 2184 Workshop, Cracow University of Technology, 1994.
7. Pi Y. L., Put B. M., Trahair N. S.: Lateral Buckling Strengths of Cold - Formed Z -Section Beams. Thin - Walled Structures. Vol. 34, 1999.
8. Winter G.: Cold - Formed, Light Gage Steel Construction. - Journal of the Structural Division. ASCE. Vol. 85, Nov., 1950.
9. Winter G.: Thin - Walled Steel Structures - Theoretical Solutions and Test Results. Preliminary Report. 8th Congress of the International Association for Bridge and Structural Engineering. 1968.
10. PN-EN 1993-1-1. Eurokod 3: Projektowanie konstrukcji stalowych. Część 1-1. Reguły ogólne i reguły dla budynków.
11. PN-EN 1993-1-3. Eurokod 3: Projektowanie konstrukcji stalowych. Część 1-3. Reguły uzupełniające dla konstrukcji z kształtowników i blach profilowanych na zimno.
12. PN-EN 1993-1-5. Eurokod 3: Projektowanie konstrukcji stalowych. Część 1-5. Blachownice.

Scientific publications of module course instructors related to the topic of the module

1. Pięciorak E., Piekarczyk M.: „Analysis of the post-buckling behaviour of a purlin built from thin-walled cold formed C profile”, Thin-Walled Structures, nr 10 - 11/2007 (916 - 920).
2. Pięciorak E., Piekarczyk M.: Interaction between zed-purlins and roof sheeting. Eurosteel 2011 : 6th European conference on Steel and composite structures : research - design - construction : August 31 - September 2, 2011, Budapest, Hungary. ECCS European Convention for Constructional Steelwork. S. 195-200.
3. Pięciorak E., Piekarczyk M.: Analysis of interaction between cold-formed zed-purlins and steel roof sheeting. International Conference on Metal Structures : Wrocław, Poland, 15-17 June 2011. S. 218-219.

Additional information

Participation in the classes is determined by prior passing the classes: “Metal structures”.