(B) Course information in English

General course information:

Course title:	Metal Structures II	**Course code:**	CE07-S04
Credits:	5	**Work load (hours):**	138
Course level:	Undergraduate ☒	Graduate ☐	
Course type:	Mandatory ☒	Selective ☐	
Course category:	Basic ☒	Orientation ☐	
Semester:	7th	**Hours per week:**	4
Course objectives (capabilities pursued and learning results):			
In conjunction with the course entitled "Metal Structures I", this specific course offers the required knowledge for the design of everyday practice steel structures, focusing on buckling response under combined loading and preloaded bolted connections, in order to achieve the capability of efficient design of simple steel structures within the basic course category.			
Prerequisites:			
Engineering Mechanics I, II, III Statics I, II Metal Structures I			

Instructor's data:

Name:	Dimitrios Sophianopoulos
Level:	Associate Professor
Office:	114A
Tel. – email:	+30 24210 74145 – dimsof@civ.uth.gr
Other tutors:	-

Specific course information:

Week No.	Course contents	Hours	
		Course attendance	Preparation
1	Determination of the natural wind actions for the structural design of buildings and civil engineering works. Modelling of wind actions, wind velocity and velocity pressure, wind actions (external and internal pressure), Structural factor, Pressure and force coefficients, pressure coefficients for buildings (vertical walls and wind velocity profile, pitched roofs, vaults and domes), wind pressure on individual structural members. Exercises and examples.	4	4
2	Loads on structures due to snow. Design situations (normal, exceptional). Snow load on the ground (characteristic values), Snow load on roofs (parameters affecting the load, load arrangements, exposure and thermal coefficients, roof shape coefficient for monopitch and pitched roofs, multi-span roofs, cylindrical roofs, roofs abutting and close to taller structures. Local effects. Snow load at Sea Level, variation with altitude and region. Exercises and examples.	4	4
3	Torsion – Warping. Causes of torsion, Torsion due to direct or indirect actions, effect of the position of the shear center, handling torsion, of bar compact circular cross-section under torsion, Torsional constant of closed mono-cellular cross-sections (2nd formula of Bredt), Torsional constant of RHS, maximum shear stresses of closed mono-cellular cross-sections (1st formula of Bredt), pure (St.Venant) torsion, non-uniform torsion, warping, mechanism of torsion, stresses and forces due to torsion and warping, design according to EC3 combined with the presence of shear. Exercises and applications.	4	6
4	Lateral and lateral-torsional buckling. The lateral buckling phenomenon, qualitative interpretation. Lateral-torsional buckling (sensitive and non-sensitive sections, differential equation of equilibrium and boundary conditions). Elastic critical moment for lateral buckling and parameters affecting it, formulae and tables. Resistance moment for lateral buckling, reduction factor, lateral buckling curves, alternative calculation method, effect of moment distribution, members with discrete lateral constraints at the compressed flange. Members under combined bending and compression, probable buckling phenomena, design checks according to EC3, Method 1 and Method 2.	4	6
5	Applications and exercises based on the material taught during the 4th week.	4	8
6	Bolted connections with pre-loaded bolts. Bolts under tension, bolts under tension and shear, mechanism of operation using preloaded bolted shear connections, slip resistance, slip factor, hole dimension tolerances, friction factor, Categories B and C, serviceability and ultimate limit states, planar plates connected with preloaded bolts. Exercises and examples.	4	6

Week No.	Course contents	Hours	
		Course attendance	Course attendance
7	Design of joints of industrial steel buildings. Presentation of various connection types related to the above type of structures, and details of joints between the corresponding members, for either framed or trussed main load bearing substructures. Assembly and detailing, drawing requirements.	4	6
8	Planar plated structural elements – Analysis and Design according to EC3. Introduction, Basis of design and modeling, Shear lag in member design, Plate buckling effects due to direct stresses at the ultimate limit state, Resistance to shear, Resistance to transverse forces, Interaction, Flange induced buckling, Stiffeners and detailing, Reduced stress method. Applications and exercises.	4	6
9	Uniform built-up compression members. General issues and modeling, Laced compression members (resistance of components, shear stiffness, effective second moment of area, constructional details), Battened compression members (resistance of components, shear stiffness, effective moments of inertia, efficiency factor, design details, closely spaced built-up members). Exercises and examples.	4	6
10	Bracing systems. Horizontal bracings (main features, alternatives, participation of purlins, general layout and load paths, diaphragmatic function of sheet cladding). Vertical braces (general layout, evaluation of different forms, used cross-sections, efficiency restrictions). Calculations and checks according to EC3. Exercises and worked examples.	4	6
11	Towards achieving successful designs in structural steel. Introduction, What is successful design, design steps, looking at the big picture, work as a team, think constructability always, the role of engineering judgment, the role of computer, the role of minimizing errors, Suggestions and guidelines, helping future engineers, Conclusions and discussion.	4	6
12	Introduction to the European Steel Design Education Program (ESPEP). History, Role of Task Committees and Working Groups, Contents of ESDEP Lectures, Continuing Education, Useful Electronic Web Resources, U.S. Steel Design Specifications. Worked Examples and Discussion.	4	6
13	Review Worked Examples	4	10
14	Presentation and evaluation of the most popular software for the design of Steel Structures. Discussion.	4	6

Additional hours for:			
Class project	**Examinations**	**Preparation for examinations**	**Educational visit**
-	3	15	-

Suggested literature:
1. A.N. Kounadis, «Steel Structures, Behavior and Analysis, Vol. I and II, Symeon Publishing, 2007. 2. I. Vayas, I. Ermopoulos, I. Ioannidis, Design of Steel Structures Kleidarithmos Publishing, 2006. 3. I. Vayas, I. Ermopoulos, I. Ioannidis, Steel Structures, Vol. I, Kleidarithmos Publishing, 2005. 4. Eurocode 3, Design of Steel Structures, Part 1-1: General Rules and rules for buildings, EN 1993-1-1, 2005. 5. Eurocode 3, Design of Steel Structures, Part 1.8: Design of Joints, EN 1993-1-8, 2005. 6. M. Bruneau, C. – M. Uang, A. Whittaker, Ductile Design of Steel Structures, McGraw-Hill 1998. 7. Eurocode 3, Design of Steel Structures, Part 1.5: Plated Structural Elements, EN 1993-1-5, 2006. 8. Eurocode 1, Actions on Structures, Part 1-4: General Actions – Wind Actions, EN 1991-1-4, 2006. 9. Eurocode 1, Actions on Structures, Part 1-3: General Actions – Snow Loads, EN 1991-1-3, 2006.

Teaching method *(select and describe if necessary -* **weight***):*		
Teaching	☒	40%
Seminars	☒	5%
Demonstrations	☒	5%
Laboratory	☐	…….%
Exercises	☒	50%
Visits at facilities	☐	…….%
Other *(describe):* ……..	☐	…….%
Total		100%

Evaluation method *(select)*- **weight:**				
	written	*%*	*Oral*	*%*
Homework	☐		☒	10
Class project	☐		☐	
Interim examination	☐		☐	
Final examinations	☒	80	☐	
Other *(describe):* Active class participation	☐		☒	10