(B) Course information in English

General course information:

Course title:	Metal Structures I	**Course code:**	CE06-S07
Credits:	5	**Work load (hours):**	136
Course level:	Undergraduate ☒	Graduate ☐	
Course type:	Mandatory ☒	Selective ☐	
Course category:	Basic ☒	Orientation ☐	
Semester:	6th	**Hours per week:**	4
Course objectives (capabilities pursued and learning results):			
Through this specific course the basic knowledge is offered, required for the evaluation at the cross-sectional and member level of steel structural elements as well as corresponding simple connection types under static loading. Examples of simple steel structures are given, as far as connectivity, geometry and loading is concerned and via specific applications the fundamental capacity checks according to EC3 are acquired.			
Prerequisites:			
Engineering Mechanics I, II, III Statics I, II			

Instructor's data:

Name:	Dimitrios Sophianopoulos
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Other tutors:	-

Specific course information:

Week No.	Course contents	Hours	
		Course attendance	Preparation
1	Introduction – Application Field of Steel Structures (Presentation and Indicative Photos). Structural Steel (Mechanical Properties, Hot Rolling, Cold Forming, Industrial Production of Steel Sections, Line of Production). Qualities of European Steels. Use of I Sections and applicability area.	4	4
2	Design and Construction of Single-Storey Steel Industrial Buildings (Basic Elements of Load-Bearing, Connectivity, Connection Types, Column Bases, Details, Statical Systems, Load Paths).	4	4
3	Decretive Framework for the Design and Construction of Steel Structures – Regulations and Philosophy of Capacity Checks – Eurocode 3 (EC3). Design limit states, partial safety factors for actions and material, combinations of actions. Members under tension – examples in structures. Principle stress check – Design resistance of members under tension according to EC3, ductility demands, Deduction for fastener holes, Angles connected by one leg and other unsymmetrically connected members in tension. Exercises and examples.	4	6
4	Simple bolted shear connection. Bolt types and categories. Bolt geometry parts and strength qualities. Positioning and types of holes, Mechanism of operation and yielding of a simple shear bolt, resistance for shear and bearing, Long bolted connections, Ductility check according to Hellenic Aseismic Code. Exercises and examples.	4	4
5	Members under transverse loading and examples in steel structural systems. Example of a cantilever beam under pure bending (deformations and stress distribution). Strong axis bending of a I-section member and stress distribution. Idealization of the behavior of structural steel (elastic-perfectly plastic model). Cross-section under pure bending, elastic response, best use of cross-sections, elastic capacity check. Distribution of shear stresses on rectangular and I- sections. Shear area, Combined actions, von Mises criterion. Cross-section under pure shear and combined bending and shear. Serviceability limit states for buildings – vertical and horizontal deflections. Cross-section under pure bending – elasto-plastic response. Moment-curvature diagrams – Plastic hinge principles. Plastic capacity check.	4	6
6	Buckling of beam-elements, slender members and thin walled members. Local buckling of members under compression and bending. Classification of cross-sections. Resistance of cross-sections under bending and / or shear loading according to EC3. Weak-axis bending of I-section members, stress distribution. Biaxial bending, elastic and plastic capacity checks. Shear center and positioning of neutral axis.	4	6

Week No.	Course contents	Hours	
		Course attendance	Preparation
7	Exercises and exemplary applications based on the courses taught during the 5th and 6th week.	4	6
8	Members under combined loading conditions. (Interaction between biaxial bending, shear loading and axial tension). Elastic and plastic resistance design of rectangular cross-sections according to EC3. Exercises and examples.	4	6
9	Members under axial compression. Local and flexural buckling. Critical loads. Euler curve. Interaction between buckling and yielding with or without the presence of initial imperfections. Normative buckling curves and corresponding requirements. Capacity check of members under axial compression according to EC3. Protection against local buckling. The effect of boundary conditions. Equivalent buckling length coefficients. Sway and non-sway frames. Lateral restraints and bracing systems. Examples and exercises.	4	6
10	Members under combined compression and bending. Examples of members in structural steel design. Flexural buckling of distinct members and representative 3D images. Elastic interaction of bending and compression. Design according to EC3.	4	6
11	Exercises and exemplary applications based on the courses taught during the 10th week.	4	6
12	Welded connections. Geometry and dimensioning (types of welds, welding consumables). Weldings with packs. Design resistance of a fillet welds, butt welds, plug welds. Connections to unstiffened flanges, long joints, angles connected to one leg. Design according to EC3. Exercises and examples.	4	6
13	Connections made with pins. General issues. Design of pins. Exercises and examples.	4	4
14	Review Worked Examples and Discussion.	4	10

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.

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