CES520 - Advanced Topics in Steel Structures

Course Title	Advanced Topics in Steel Structures				
Course Code	CES520				
Course Type	Compulsory				
Level	MSc (Level 2)				
Year / Semester	1st / 2nd				
Teacher's Name	Antonis Michael				
ECTS	7	Lectures / week	3	Laboratories / week	
Course Purpose	This course deals with advanced topics related to steel structural design. In the BSc level courses students are trained to design structural elements under relatively simple loading. This course aims to give the tools to students to tackle more complex issues with the design of steel structures and deal with more complex loading such a wind loading. The students will be able to apply plastic analysis methods in the design of steel structures. With the completion of this course students will be able to perform their own research on particular aspects or practical applications, find design information (loads, analysis approaches, etc.), apply code requirements and analyze/design not only individual elements of a structure but analyze and design the structure as a whole.				
Learning Outcomes	1. Form the design philosophy for all the elements of a typical steel structure. 2. Evaluate methods of designing steel structural elements including tension members, compression members, beams and beam-columns. 3. Apply steel design methods to complete design of portal frames and multi-storey frameworks, including connection details. 4. Evaluate the importance of bracing systems in multi-storey buildings. 5. Employ plastic analysis methods for the design of steel structures.				
Prerequisites	None	Corequisites	None		
Course Content	**Introduction:** Design philosophy, structural analysis and basis of codes of practice, Eurocode 3. **Steel component design:** Design of steel components: local buckling, cross-section classification, design of tension members, compression members, beams and columns under combined loads (Lateral torsional buckling). **Steel connections:** Design of steel connections, general consideration of bolts and welds, analysis and design of connections. Connections in portal frames and trusses. **Plastic Analysis:** Theory of Plasticity, plastic design concepts, lower bound solution based on equilibrium, upper bound solution based on mechanism kinematics. **Tall Buildings:** Effect of wind on tall buildings, strategies for reduction of wind excitation, shape modification and dumpers, wind loading calculations (EN1991-1-4).				

	Bracing systems: Horizontal (or wind) bracing systems, vertical bracing systems, seismic behavior of the vertical bracings.
Teaching Methodology	The course is presented through theoretical lectures in class and experimental exercises in the laboratory. The lectures present to the student the course content and allow for questions. Part of the material is presented using visual aids. The aim is to familiarize the student with the different and faster pace of presentation and also allow the instructor to present related material (drawings, graphs, photographs etc.) that would otherwise be very difficult to do. As part of the learning process students are required to solve course related problem exercises. Exercises are given as homework assignments which are part of the student course assessment. Students are expected to take notes in class during lectures; however, all course material is available to students through the class website on the e-Learning platform. Students are assigned a design project which requires them to collect data for the design of a steel structure on their own. This can be achieved only if the students research the specific subject. They need to find imposed loads, model the structure, analyze it and come up with a design, or investigate different parameters and their effect on the structure. The students are required to present their work in class and submit an electronic report showing all of their work. Finally the instructor will be available to students during office hours or by appointment in order to provide any necessary tutoring.
Bibliography	**Textbooks:** 1. "Design of Steel Structures to Eurocodes", Ioannis Vayas, John Ermopoulos and George Ioannidis, 2019, Springer Tracts in Civil Engineering, ISBN 978-3-319-95473-8, ISBN978-3-319-95474-5 (eBook), https://doi.org/10.1007/978-3-319-95474-5. 2. "Examples in Structural Analysis", William M.C. McKenzie, 2006, Taylor and Francis, ISBN13: 978-0-415-37053-0 (hbk), ISBN13: 978-0-203-03037-0 (ebk). **References:** 1. EN 1993-1-1: Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings. 2. EN1993-1-8: Eurocode 3: Design of steel structures – Part 1-8: General – Design of joints. 3. EN1991-1-4: Eurocode 1: Wind Actions.
Assessment	Student assessment is based on homework assignments, an individual project, midterm exams and a final exam. The assessment criteria are provided with each assignment, project and exam for the specific course. The weights for each assessment method are as follows: Midterm Exams 20% Homework Assignments 10% Design Project 20% Final Exam (Comprehensive) 50%
Language	English