

Course unit title	ADVANCED DESIGN OF STEEL AND COMPOSITE STRUCTURES
Course unit code	2C08
Type of course unit	Compulsory
Semester	2
Number of ECTS credits allocated	6
Name of lecturer(s)	Machaček (CTU); Lecturer (UC); Lecturer (UNINA); Dubina/Ciutina/Ungureanu(UPT); Demonceau (ULg); Nilsson (LTU); Y. Nazim / Dombas (Associate 1); Lecturer (Associate2).
Learning outcomes of the course unit	<p>Aim</p> <p>The aim of the course is to present the structural solutions for the main categories of steel and composite steel-concrete structures applied in buildings and industrial construction.</p> <p>The following types of construction are concerned:</p> <ul style="list-style-type: none"> - industrial buildings - tall buildings - large span structures - plated and shell structures - lightweight structures <p>On the purpose to give students a global approach of the specific problems to given construction type, the specific lectures are organised according to the following integrated structure:</p> <ul style="list-style-type: none"> - specific structural typologies and detailing - loading conditions and design criteria - analysis and design checking at ULS and SLS - specific requests for execution and erection <p>Particular aspects related to stability problems, dynamics, fatigue and specific connecting design will be addressed where and when they are significant. Also, the use of high performance materials for steel and/or concrete or composite will be tackled.</p> <p>Relevant parts of EN 1993 and EN 1994 as well as of EN 1990 and EN 1991 will be employed for the calculation of such elements.</p> <p>The theoretical part is supplemented with practical analyses by various methods: analytical and FE analysis, design project.</p>

	<p>Skills</p> <p>The course is conceived in order to give students the following skills:</p> <ul style="list-style-type: none"> - Adopting different design approaches as appropriate for the characteristic structural system - Understanding the behaviour of different steel and composite structures. - Understanding ULS and SLS conditions for different structural typologies. - Assigning best detailing according to structural system. - FE analysis, numerical design, and interpretation of results.
Mode of delivery	Frontal lesson , seminary and laboratory work, homeworks
Prerequisites and co-requisites	i.e. general admission requirements
Course contents	<p>Analysis and design methodologies for special steel and composite steel-concrete structures will be explained and detailed.</p> <p>The course is devoted to cover the following main topics:</p> <ol style="list-style-type: none"> I. Industrial buildings II. Tall buildings III. Large span structures IV. Plated and shell structures V. Lightweight steel constructions
Recommended or required reading	<p>Steel and composite steel-concrete Eurocodes and normatives ECCS design recommendations Access Steel website (www.access-steel.com) Luís Simões da Silva, Rui Simões and Helena Gervásio, Design Of Steel Structures, ECCS Ernst & Sohn ISBN (ECCS): 978-92-9147-098-3, 2010 Buckling of Steel Shells - European Design Recommendations ECCS ISBN (ECCS 92-9147-000-92, 2008 Darko Beg; Ulrike Kuhlmann; Laurence Davaine; Benjamin Braun, Design of Plated Structures, , ECCS Ernst & Sohn ISBN (ECCS): 978-92-9147-100-3, 2010 Design of Cold-formed Steel Structures Eurocode 3: Design of Steel Structures Dan Dubina, Viorel Ungureanuand Rafaelle Landolfo Eurocode 3 Part 1-3 – Design of Cold-formed Steel Structures, ECCS, in print Richard Liew, J.Y.; Balendra, T. and Chen, W.F. “Multistory Frame Structures” Structural Engineering Handbook Ed. Chen Wai-Fah Boca Raton: CRC Press LLC, 1999 David A. Nethercot, Composite Constructions, Spon Press – Taylor and Francis, 2004</p>

<p>Planned learning activities and teaching methods</p>	<p>Course content</p> <p>The course is conceived for 12 weeks:</p> <p>1 – Single story buildings (non-residential buildings and industrial halls):</p> <ul style="list-style-type: none"> - Typology of single-story buildings - Specific loading conditions: climatic actions, technological actions etc. - Details and structural typologies: main frame, secondary structure, cladding and roof, connections - Design for resistance and stability (ULS) and serviceability (SLS) criteria. <p>2 – Multi-story buildings:</p> <ul style="list-style-type: none"> - Design concepts and structural systems: gravity frames, bracing systems, moment-resisting frames, dual frames, steel-concrete composite systems, influence of joint behaviour. - Specific loading conditions: permanent, imposed, lateral loads (wind, earthquake) etc. - Composite floor systems: composite beams, composite floors, slim-floors. - Methods for global analysis. - Design for resistance and stability criteria (ULS). SLS conditions to vertical and horizontal loads. - Robustness of multi-story buildings: impact, explosion, fire, use of high performance materials. <p>3 – Large span structures:</p> <ul style="list-style-type: none"> - Design concepts and structural systems: reticulated structures for roof systems, truss structures, suspended structures - Specific loading conditions: heavy climatic conditions (snow, wind) - ULS and SLS conditions: stability, dynamics. <p>4 – Plated and shell structures:</p> <ul style="list-style-type: none"> - Application of plated structures. - Strength and stability of plated structures: behaviour in shear, bending, compression, combined loads. - Application of shell structures. - Strength and stability of shell structures: membrane theory, bending theory. <p>5 – Lightweight steel structures:</p> <ul style="list-style-type: none"> - Application of lightweight steel construction.
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	<ul style="list-style-type: none"> - Characteristics of cold-formed steel profiles: effective geometrical characteristics, design resistance and stability criteria, connecting design and technology - Residential steel lightweight buildings: specific loading, conditions for design at ULS and SLS, constructive details. - Roofing and cladding systems: diaphragm effect, constructive detailing, technological conditions. <p>Applications</p> <p>The applications are done under the form of practical applications and project:</p> <p>Practical applications:</p> <ul style="list-style-type: none"> - Stability of columns - Design of a plated girder - Design of composite columns - Design of a roof purlin (cold-formed thin-walled element) <p>Project (elective):</p> <ul style="list-style-type: none"> - Industrial hall - Multi - storey building - Residential house in cold-formed steel solution
<p>Assessment methods and criteria</p>	<p>Approved assignments will be necessary to prepare at the end of the course on the work performed during the course.</p> <p>Grading system. Passed or not passed. A certificate awarding ECCS credits may be provided upon the request.</p>
<p>Language of instruction</p>	<p>English</p>