

<b>Course unit title</b>	<b>DESIGN OF ALUMINUM AND STAINLESS STEEL STRUCTURES</b>
<b>Course unit code</b>	2C14
<b>Type of course unit</b>	Elective
<b>Semester</b>	2
<b>Number of ECTS credits allocated</b>	5
<b>Name of lecturer(s)</b>	Josef MACHACEK, František WALD (CTU); Lecturer (UC); Lecturer (UNINA); Lecturer (UPT); Lecturer (ULg); Lecturer (LTU); Lecturer(Associate 1); Lecturer (Associate2).
<b>Learning outcomes of the course unit</b>	<p><b>Aim</b></p> <p>The course will supply students with basic information on material bases, behaviour and design of load bearing civil engineering structures from aluminium alloys and stainless steels.</p> <p>Expansion of structures made of aluminium alloys and stainless steels during last decades will be demonstrated and advantages per chance drawbacks of using these materials will be discussed.</p> <p>The first part of the course will be devoted to structures from aluminium alloys. Selection of suitable materials for given structure, material properties and application examples will be provided.</p> <p>Subsequently primary information on design in accordance with Eurocode 9 (Design of aluminium structures) will supply students with view concerning differences with respect to design of steel structures. Heat affected zone softening (HAZ) will be shown and corresponding effect on design. The course will cover design from the view of both ultimate and serviceability limit states, including design of various types of connections. Finally advanced models beyond elastic limit will be demonstrated and further possibilities of design using educational programme TALAT and others will be provided.</p> <p>The second part of the course will be devoted to structures from stainless steels. Trends in design using stainless steels and recent notable structures will be discussed. Again a survey of general stainless steel materials and those suitable for civil engineering structures will be provided. The information on design will follow Eurocode 3 (General rules - Supplementary rules for stainless steels) and recommendations of Euro Inox. The course will cover design from the view of both ultimate and serviceability limit states, including design of various types of connections. Special attention will be given to erection and installation of stainless steel structures in respect to need of specific treatment, handling and storage of stainless steel elements and structures.</p>

	<p><b>Skills</b></p> <p>The course is conceived in order to give students following skills:</p> <ul style="list-style-type: none"> <li>- Understanding of advantages and drawbacks in using such materials as aluminium alloys and stainless steels in load bearing civil engineering structures.</li> <li>- To be able to choose the suitable aluminium alloy or stainless steel for given structure.</li> <li>- Understanding of specialities in behaviour of structural elements of aluminium alloys and stainless steels.</li> <li>- Knowledge of basic design of elements from aluminium alloys and stainless steel based on Eurocode approach.</li> <li>- Understanding of connection possibilities and assembly methods in connecting elements and structures from aluminium alloys and stainless steels.</li> <li>- Knowledge how to practically design columns and beams made from aluminium alloys and stainless steels.</li> </ul>
<b>Mode of delivery</b>	Frontal lessons, seminar k and home work
<b>Prerequisites and co-requisites</b>	No requirements
<b>Course contents</b>	<p>Aluminium structures, HAZ softening, Design of aluminium elements, Design of aluminium connections, Design beyond the elastic limit, Aluminium advanced design, Stainless steel structures, Stainless steel material and material properties, Specialty in design of stainless steel structural elements, Stainless steel connection design, Erection and installation of stainless steel structures, Stainless steel advanced design. Several useful software tools for easy application of these models will be presented.</p> <p>Students should be able to predict the behaviour of aluminium and stainless steel elements and structures. This will be documented on simple elements such as beams and columns and complex structures. The students practise the design methods according to European standards to be able to perform structural design.</p>
<b>Recommended or required reading</b>	<p>Eurocode 9 (EN 1999: Design of aluminium structures. Part 1 to Part 5)</p> <p>Mazzolani F. M.: Aluminium alloy structures, E &amp; FN SPON, London, 1995.</p> <p>Valtinat G.: Aluminium im Konstruktivem Ingenierbau, Ernst &amp; Sohn, Berlin, 2003.</p> <p>TALAT, URL: <a href="http://www.eaa.net/eea/education/TALAT">www.eaa.net/eea/education/TALAT</a></p> <p>Eurocode 3 (EN 1993-1-4: Design of steel structures – Part 1-4: General rules - Supplementary rules for stainless steels)</p> <p>Euro-Inox: <a href="http://www.euro-inox.org/">http://www.euro-inox.org/</a></p> <p>Design Manual for Structural Stainless Steel. Euro Inox and The Steel Construction Institute, 2006</p>

<p><b>Planned learning activities and teaching methods</b></p>	<p>Twelve topics, listed below are covered in the course.</p> <p><b>Lectures:</b></p> <ol style="list-style-type: none"> <li><b>1. Aluminium structures</b> Introduction, structural aluminium, materials selection, material properties for wrought aluminium and cast aluminium alloys, application: examples, cranes, ships, facades, scaffolds, approach according to Eurocode, references, educational programme TALAT.</li> <li><b>2. HAZ softening</b> HAZ softening adjacent to welds, classification of cross-sections.</li> <li><b>3. Design of aluminium elements</b> Resistance of cross-sections, buckling resistance of members, serviceability limit states for buildings.</li> <li><b>4. Design of aluminium connections</b> Basis of design, welded connections, heat-affected zone HAZ, connections made with bolts, rivets and pins, adhesive bonded connections, adhesives.</li> <li><b>5. Design beyond the elastic limit</b> Behaviour of cross-sections beyond the elastic limit rotation capacity, torsional and torsional-flexural buckling.</li> <li><b>6. Aluminium advanced design</b> Analytical models for stress strain relationship, properties of cross sections with fillets and bulbs.</li> <li><b>7. Stainless steel structures</b> Trends in design, examples of structures, specialty of design.</li> <li><b>8. Stainless steel material and material properties</b> Austenitic, duplex, ferritic, martensitic, precipitation hardened and lean steels. Designation, properties and use.</li> <li><b>9. Specialty in design of stainless steel structural elements</b> Differences between design of elements from carbon and stainless steel, SLS, ULS, buckling of plate elements, tension, compression, shear, bending, lateral-torsional buckling, interactions.</li> <li><b>10. Connection design</b> Mechanical connections, welding, connection material. Design and execution of connections.</li> <li><b>11. Erection and installation of stainless steel structures</b> Methods of erections, tolerances, transportation, handling and storage, surface protection, cleaning, contact with other metals, flatness.</li> <li><b>12. Stainless steel advanced design</b> Trends in design, research in stainless steel, progress of stainless steel structures.</li> </ol> <p><b>Seminars:</b></p> <ol style="list-style-type: none"> <li>1. Design of aluminium truss girder.</li> <li>2. Design of aluminium welded beam.</li> <li>3. Design of stainless steel girder.</li> <li>4. Design of stainless steel column with welded I cross section.</li> </ol>
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<b>Assessment methods and criteria</b>	Approved compulsory assignments will be necessary to prepare a public presentation at the end of the course on the work performed during the course. Grading system. Passed or not passed. A certificate awarding ECCS credits after the course accomplishment may be provided upon the request.
<b>Language of instruction</b>	English