Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Mechanics and Design of Sustainable Structures
Code der Lehrveranstaltung	45551
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	
Sprache	Englisch
Studiengang	Master in Energie-Ingenieurwissenschaften
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Maria Pantano, Maria.Pantano@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/35831 Dr. Nicola Tondini, Nicola.Tondini@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/37176
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
Studienjahr/e	2
KP	6
Vorlesungsstunden	60
Laboratoriumsstunden	0
Stunden für individuelles Studium	90
Vorgesehene Sprechzeiten	18
Inhaltsangabe	The course investigates good practice in the design of steel structures, presenting requirements, standards and methodologies that have to be followed in order to design efficient yet reliable

	structures. The students attending this course are expected to learn how to design key components in steel structures to be implemented in systems for energy and sustainable applications, including wind energy, hydraulic energy, solar energy and bioenergy and relevant industrial plants.
Themen der Lehrveranstaltung	Design based on modern national and European standards. - Global analysis of structures. - Stiffness and strength of elements. - Effect of geometrical and mechanical imperfections on the load bearing capacity of steel elements. - Resistance of steel members to tension, compression, bending, shear and combined actions. - Buckling resistance of steel members. - Stability of steel shell elements. - Fatigue of steel structures - Bolted and welded connections and joints. - Design of bolted connections. - Worked examples. - Verification of a sustainable structural system: Wind turbine mast.
Stichwörter	Structures; Stiffness and strength of elements; Steel elements; Fatigue; Connections and joints.
Empfohlene Voraussetzungen	Recommended preliminary knowledge: For a fruitful attendance of the course basic knowledge of solid and structural mechanics is needed.
Propädeutische Lehrveranstaltungen	
Unterrichtsform	Class lectures (blackboard and/or slides). Some of the lecture material (slides) will be available for download by the students.
Anwesenheitspflicht	Not mandatory.
Spezifische Bildungsziele und erwartete Lernergebnisse	The course investigates good practice in the design of steel structures, presenting requirements, standards and methodologies that have to be followed in order to design efficient yet reliable structures. The students attending this course are expected to learn how to design key components in steel structures to be implemented in systems for energy and sustainable applications, including wind energy, hydraulic energy, solar energy and bioenergy and relevant industrial plants.

Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	Learning outcomes Knowledge and understanding 1. Knowledge of the main mechanical properties of materials and conception of structures, with particular reference to steel, as well as the main technical standards used in steel structural applications. Applying knowledge and understanding 2. Capability of recognizing where steel and steel structures could be profitably used in energy and sustainable systems, such as those related to wind, hydraulic or solar energy, and capability of defining requirements in the design of the steel structures for energy applications. Making judgements 3. The student will be able to assess the validity of the design of an existing steel structure, identify critical aspects and suggest redesign solutions and improvements in structural performance. Communication skills 4. The student will be able to discuss the learned knowledge with vocabulary and technical terms of the discipline, describing the outcome of the design activity and the features of different solutions efficiently. Learning skills 5. Lifelong learning capability through the acquisition of critical tools and critical evaluation of product and systems specifications.
Art der Prüfung	Oral examination with questions aimed at verifying the knowledge and the capability to understand the topics of the course and the mastery of the technical language. The capability to transfer these competences to applicative cases and the developed autonomy of judgment will be evaluated through the discussion of the design work assigned during the course. - Formative assessment: Development of the assigned design work: during the course; ILOs assessed: (2), (3), (5) - Summative assessment: Oral examination, including discussion of the design work: about 1 hour; ILOs assessed: all, except (5)

Bewertungskriterien	A single final vote will take into account knowledge of the topics presented during the course, ability to synthesize information, correctness of the technical terms and clarity (50 %). With reference to the developed design work, the capability to analyze the proposed problem and to design reliable steel components in structures for energy applications will be taken into account (50 %).
Pflichtliteratur	European technical standard: UNI EN 1993-1-1 • D. Roylance, Modules in Mechanics of Materials, A web based collection of educational modules developed under the auspices of the National Science Foundation. MIT course • Davoli et al. "Comportamento meccanico dei materiali", Mc Graw-Hill. • Bursi, O.S., Pucinotti, R., Zanon, G., Progettazione di Giunzioni e Strutture Tubolari in Acciaio, Flaccovio, September 2012 | ISBN: 978-88-579-0158-9 • Simoes da Silva L., Simoes R. e Gervasio H., Design of Steel Structures, 2nd Edition, ECCS, 2016. • Nussbaumer A., Davaine L., Borges L., Fatigue Design of Steel and Composite Structures: Eurocode 3: Design of Steel Structures, Part 1-9 Fatigue; Eurocode 4: Design of Composite Steel and Concrete Structures, 2011
Weiterführende Literatur	• Cocco, D., Palomba, C., Puddu, P., "Tecnologie delle Energie Rinnovabili", SGEditoriali , Padova, 2010. • Battisti, L., Gli Impianti Motori Eolici, Editore L. Battisti , Agosto 2012
Weitere Informationen	Connections with other courses: This course complements the knowledge offered by the other courses of the Master programme. Professional applications of the covered topics: The topics presented in this course can be applied in all those professional activities involving the design and the re-design of building systems, as well as specific elements of energy structural systems, that are typically performed in engineering offices and building companies.
Ziele für nachhaltige Entwicklung (SDGs)	Industrie, Innovation und Infrastruktur, Nachhaltiger Konsum und Produktion, Nachhaltige Städte und Gemeinden

Titel des Bestandteils der Lehrveranstaltung	Mechanics
Code der Lehrveranstaltung	45551A
Wissenschaftlich-disziplinärer Bereich	CEAR-06/A
Sprache	Englisch
Dozenten/Dozentinnen	Prof. Maria Pantano, Maria.Pantano@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/35831
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
KP	3
Verantwortliche/r Dozent/in	
Vorlesungsstunden	60
Laboratoriumsstunden	0
Stunden für individuelles Studium	15
Vorgesehene Sprechzeiten	9
Inhaltsangabe	Overview of the applications and benefits of steel and steel structures in energy engineering systems, with emphasis on sustainability aspects. Mechanical properties of structural materials, with specific attention to steel and concrete. Standards for the design of steel structures according to European rules. Plasticity. Elements of structural dynamics and fatigue. Exercises with theoretical applications.
Themen der Lehrveranstaltung	The topics presented in this course can be applied in all those professional activities involving the design and the re-design of building systems, as well as specific elements of energy structural systems, that are typically performed in engineering offices and building companies.
Unterrichtsform	Teaching format Class lectures (blackboard and/or slides). Some of the lecture material (slides) will be available for download by the students.

Pflichtliteratur	European technical standard: UNI EN 1993-1-1 • D. Roylance, Modules in Mechanics of Materials, A web based collection of educational modules developed under the auspices of the National Science Foundation. MIT course • Davoli et al. "Comportamento meccanico dei materiali", Mc Graw-Hill. • Bursi, O.S., Pucinotti, R., Zanon, G., Progettazione di Giunzioni e Strutture Tubolari in Acciaio, Flaccovio, September 2012 | ISBN: 978-88-579-0158-9 • Simoes da Silva L., Simoes R. e Gervasio H., Design of Steel Structures, 2nd Edition, ECCS, 2016.
Weiterführende Literatur	• Cocco, D., Palomba, C., Puddu, P., "Tecnologie delle Energie Rinnovabili", SGEditoriali , Padova, 2010. • Battisti, L., Gli Impianti Motori Eolici, Editore L. Battisti , Agosto 2012.

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Design
Code der Lehrveranstaltung	45551B
Wissenschaftlich-disziplinärer Bereich	CEAR-07/A
Sprache	Englisch
Dozenten/Dozentinnen	Dr. Nicola Tondini, Nicola.Tondini@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/37176
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Erstes Semester
KP	3
Verantwortliche/r Dozent/in	
Vorlesungsstunden	60
Laboratoriumsstunden	0
Stunden für individuelles	15

Studium	
Vorgesehene Sprechzeiten	9
Inhaltsangabe	Design based on modern national and European standards. Global analysis of structures. Stiffness and strength of elements. Effect of geometrical and mechanical imperfections on the load-bearing capacity of steel elements. Resistance of steel members to tension, compression, bending, shear and combined actions. Buckling resistance of steel members. Stability of steel shell elements. Bolted and welded connections and joints. Design of bolted connections. Worked examples. Verification of a sustainable structural system: Wind turbine mast.
Themen der Lehrveranstaltung	The topics presented in this course can be applied in all those professional activities involving the design and the re-design of building systems, as well as specific elements of energy structural systems, that are typically performed in engineering offices and building companies.
Unterrichtsform	Class lectures (blackboard and/or slides) and design exercises using spreadsheets. Some of the lecture material (slides) will be available for download by the students.
Pflichtliteratur	European technical standard: UNI EN 1993-1-1 • D. Roylance, Modules in Mechanics of Materials, A web based collection of educational modules developed under the auspices of the National Science Foundation. MIT course • Davoli et al. "Comportamento meccanico dei materiali", Mc Graw-Hill. • Bursi, O.S., Pucinotti, R., Zanon, G., Progettazione di Giunzioni e Strutture Tubolari in Acciaio, Flaccovio, September 2012 | ISBN: 978-88-579-0158-9 • Simoes da Silva L., Simoes R. e Gervasio H., Design of Steel Structures, 2nd Edition, ECCS, 2016.
Weiterführende Literatur	• Cocco, D., Palomba, C., Puddu, P., "Tecnologie delle Energie Rinnovabili", SGEditoriali , Padova, 2010. • Battisti, L., Gli Impianti Motori Eolici, Editore L. Battisti , Agosto 2012.