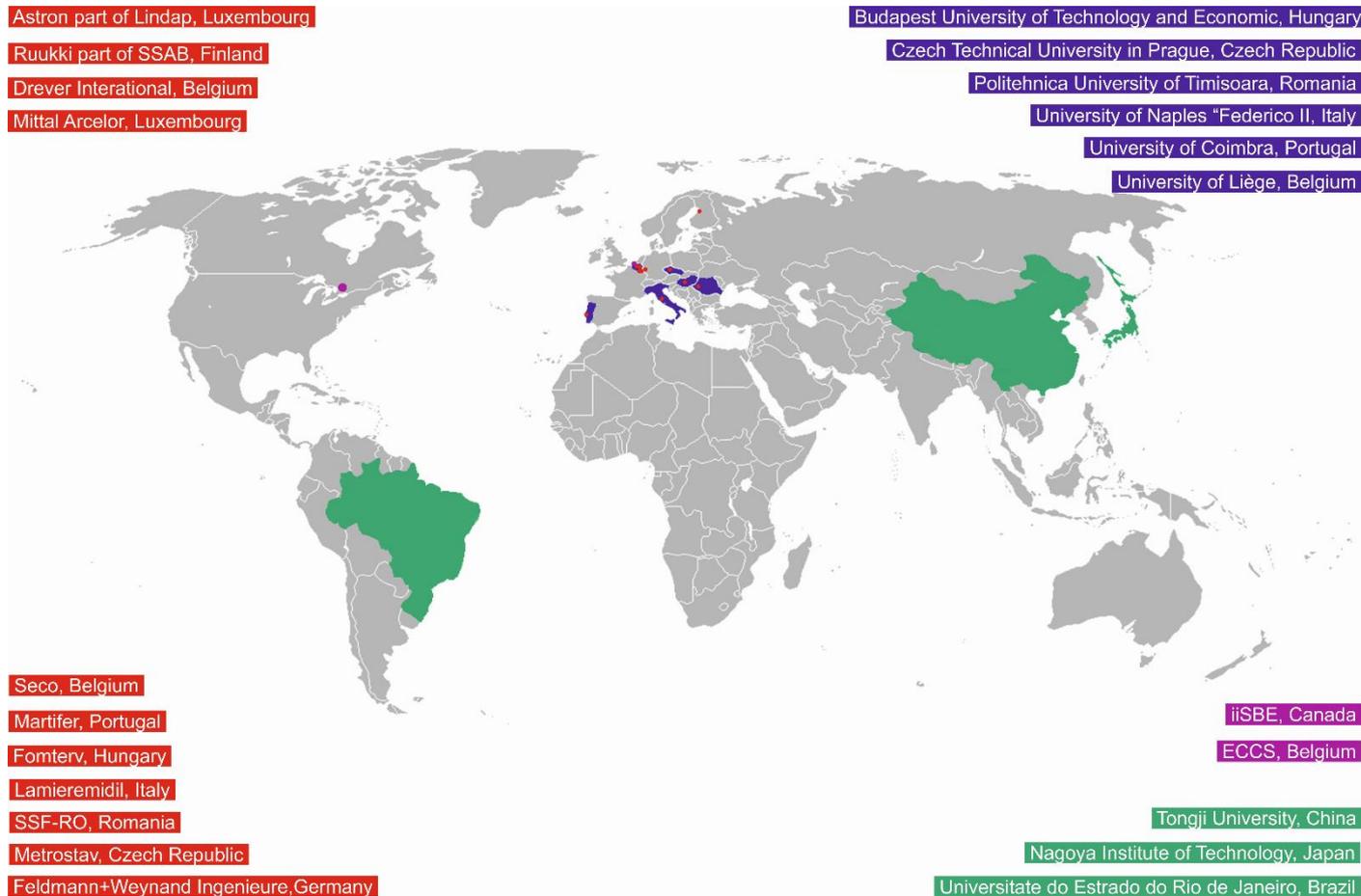


# Application

for Erasmus Mundus Joint Master Degrees (EMJMD) 2017

## Sustainable Constructions under Natural Hazards and Catastrophic Events

SUSCOS\_M



## ANNEX 14

### Learning outcomes for courses

### **1C01 ENVIRONMENTAL ENGINEERING**

in charge University of Coimbra

Clear understanding of the concepts of Sustainable Development (SD) and Sustainable Construction (SC). To understand the challenge of the application of the principles of SD to the construction sector. To identify the advantages and disadvantages of steel and steel construction in the context of SC. To take advantage of steel structures in the pursuit of SC. To provide essential knowledge in relation to methodologies and tools for the assessment of sustainability. Using information models and methodology (BIM) for LCA, sustainable design and construction and certification information exchange. To apply these skills in the promotion of steel buildings in the context of SC.

### **1C02 CONCEPTUAL DESIGN OF BUILDINGS**

in charge Czech Technical University in Prague

The students should, at the end of the unit, be able to conceptually design a building through the selection, in a wide library of structural solutions, of the most appropriate ones to be implemented. To achieve it, they will rely on their knowledge of these technical solutions, but also on their acquired ability to integrate various other conceptual aspects as the feasibility and the economy of the project and the capability to use 3D structural analysis and information models (BIM) software for this purpose.

### **1C03 LOCAL CULTURE AND LANGUAGE**

The course is an introduction to the Host country's society and the political and social system governing the country. After completing the course, the student should be able to: describe significant aspects of the Host country's society from a geographical, social and historical perspective; carry out comparative studies between Host country's society and the conditions in the student's home countries; have a basic knowledge of the Host country's speech and writing, to be able to communicate in "everyday" situations; perform and present written reports within given instructions and time frames

### **1E04 CONCEPTUAL DESIGN OF BRIDGES**

in charge Budapest University of Technology and Economics

The students should, at the end of the unit, be able to conceptually design a bridge through the selection, in a wide library of structural solutions, of the most appropriate ones to be implemented. To achieve it, he will rely on his knowledge of these technical solutions, but also on his acquired ability to integrate various other conceptual aspects as the feasibility and the economy of the project and optimization using information models (BIM).

### **1E05 ADVANCED DESIGN OF CONCRETE STRUCTURES**

in charge University of Coimbra

After completing the course, the student is expected to have understanding for calculation and design of the main elements in reinforced concrete structures according to current building codes. Be able to understand the behaviour of reinforced concrete structures. Carry out calculations on safety verification of reinforced concrete members. Have skill to design r.c. structural members and components. Be able to understand the behaviour of joints diagrams, normal force, shear force and bending moments have skills in mechanics that give the basis for construction subjects, be able to describe theories and solution methods in mechanics, understand the subject's importance to other courses in the civil engineering programme including information models as data source for concrete structures analysis and information exchange

### **1E06 ADVANCED DESIGN OF TIMBER STRUCTURES**

in charge Budapest University of Technology and Economics

The aim of this course is to give students the latest knowledge about the timber structures. To describe the historical development of the use of timber in building and engineering structures and to develop an awareness of significance of timber as a traditional structural material. To focus attention on the essential properties of timber which have to be considered in the design, detailing and construction of timber structures. To develop an understanding of importance of strength grading in process of converting wood, a natural raw material, into timber for structural use. To introduce new high strength wood-based materials and using information models as source data for timber structures analysis. To describe the

Eurocode principles for safety and serviceability and the bases of design common to all materials, together with the special rules for timber structures necessitated by, for example, the effects of load duration and moisture content.

### **1E07 ADVANCED DESIGN OF GLASS STRUCTURES**

in Charge Czech Technical University in Prague

The course is intending to introduce the students the field of structural applications of glass and to give them some specific skills for calculation and detailing of for basic glass structures: panes beams and fins, columns and walls, point-supported glass, as well as for glazing systems such as glass facades, canopies and roofs, stairs and floors. On this purpose the properties of glass as structural material will be presented in comparison with other basic building materials, together with selected examples of glass/glazing applications. Design details and connecting technology, relevant technical regulations, specification and current methods applied in design will be described. Worked examples will accompany the lectures for better understanding, and design project will help to fix specific knowledge.

### **1E08 FIBRE REINFORCED POLYMERS**

in charge Budapest University of Technology and Economics

The course is intending to introduce the students the field of structural applications of fibre reinforced polymers and to give them some specific skills for calculation and detailing of basic FRP structures. The FRP orthotropic properties will be described, together with glass, resin and carbon properties. The lectures will give the knowledge for the application of pultruded GFRP profiles for structural use, laminated GFRP plates and shells, CFRP profiles and lamellas. The application of FRP (especially CFRP) for the strengthening of structures will be shown as well. Design details and connecting technology (bolts, rivets, bonding), relevant technical regulations, specification and current methods applied in design will be described. Worked examples will accompany the lectures for better understanding, and design project will help to fix specific knowledge.

### **1E09 ELECTIVE COURSE FROM LOCAL OFFER**

The students will have an opportunity to select courses from the list offered for Erasmus+ students at each University to complete their profile and to meet and work with local students and Erasmus+ students. The list of courses is available at each partner University, e.g. [intranet.cvut.cz/incomers/erasmus-exchange/prospectus](http://intranet.cvut.cz/incomers/erasmus-exchange/prospectus).

### **2C10 BUSINESS ECONOMICS AND ENTREPRENEURSHIP**

in charge "Polytechnica" University of Timisoara

The aim of this course is to give clear understanding of the concepts of macro and micro economics; to identify the relevant issues from economics for application in the construction sector; to develop skills for innovation and risk taking; to understand production and operational issues in industrialised construction; to apply these skills to the construction sector. BIM procurement and contracting during construction project life cycle and integrated project delivery (IPD) procurement is included with contractual, financial, project risks and the impact of BIM on risk analysis and management of infrastructure projects.

### **2C11 ADVANCED DESIGN OF STEEL AND COMPOSITE STRUCTURES**

in charge University of Liege

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. The following types of construction are concerned: industrial buildings, tall buildings, large span structures, plated and shell structures, lightweight structures. Using advanced design procedures and information models as data source for steel and composite structures analysis and information exchange.

### **2C12 RELIABILITY AND RISK-BASED DESIGN OF INFRASTRUCTURE SYSTEMS**

in charge University of Liege

Probabilistic reliability and risk methods are becoming more and more frequently applied in design and decision making concerning new and existing infrastructures. The course provides basic methods for

design of complex technological systems consisting of structural subsystems (buildings, bridges, tunnels) and subsystems of protective elements (barriers, sprinklers, fire detectors etc.). Uncertainties in specifying system properties and expected environmental influences with return periods over decades and centuries (wind storms, severe snowfalls, floods) are described by probabilistic models. Advanced theoretical approaches including Bayesian networks are applied to assess societal, economic and other consequences of adverse events and alternative decisions. Using BIM tools and methods to mitigate risks in design phase of project life cycles as clash detection, behavioural analysis etc.

### **2E13 URBAN PLANNING**

in charge University of Naples "Federico II"

This course explores important substantive areas and concepts in the field of urban and regional planning and current urban planning and policy issues and debates. Topics include: forces that have historically guided and are currently guiding EU urbanization; land use, growth management, transportation and traffic congestion, economic development, housing and community development, environmental planning; legal, environmental, governmental contexts. Students will enhance their skills in conducting research, applying source material, discussing general information, and applying logical process when writing.

### **2E14 ROBUSTNESS OF STRUCTURES EXPOSED TO FIRE AND EXPLOSION**

in charge University of Liege

The aim of this course is to give students an understanding of the design methods of structures at accidental situations, fire and explosion. The course is focussed on all design methods involved in fire design: prediction of fire scenario, evaluation of fire load, calculation of gas temperatures in the fire compartment, evacuation and structural analysis. Special attention is paid to explosion modelling when several design models for structural robustness will be offered including advanced design procedures and information models.

### **2E15 ROBUSTNESS OF STRUCTURES AGAINST SEISMIC AND EXCEPTIONAL LOADINGS**

in charge University of Naples "Federico II"

After completing the course, the student is expected to be able to understand the dynamic behaviour of constructions and the effect of dynamic loads; have skills in structural dynamics that give the basis for construction subjects; have skill to design steel structural systems and components able to attenuate or withstand seismic actions; carry out calculations with the aid of finite element methods; understanding the principles and methods of dynamic analysis; have skills to apply the rules and verifications given by European codes; be able to design, draw seismic resistant steel structures.

### **2E16 DESIGN FOR RENEWABLE ENERGY SYSTEMS**

in charge "Polytechnica" University of Timisoara

The aim of this course is to give students an understanding of the behaviour of steel tubular towers for wind turbines, using analytical and numerical methods and to practice design calculations. In addition other lattice towers and different types of concrete towers combination will be discussed The Eurocodes are used throughout the course to calculate the structural resistance. The "International version of the codes" will be used in the course and students will have opportunity to borrow prepared compendiums which will be returned afterwards. This version of the Eurocodes is prepared by the international experts and is not nationally adjusted.

### **2E17 CLIMATE CHANGE IMPACT ON BUILT ENVIRONMENT**

in charge "Polytechnica" University of Timisoara

The aim of this course is to give students the understanding of the changes with take place in the climate across the globe, and how these changes can affect our built environment. The most visible signs of climate change can be seen through the extreme weather events taking place worldwide (heavy snow, extreme winds), more often and with more intensity, thus increasing the load effect. Other signs however are difficult to evaluate and can influence on long term the safety, durability and health of the built environment (temperature, humidity, levels of precipitation, emissions), thus reducing the resistance and

durability of the material. Therefore, the data related to climate changes need to be classified and quantified to evaluate the results of the interaction hazard-vulnerability-exposure.

### **2E18 ELECTIVE COURSE FROM LOCAL OFFER**

The students will have an opportunity to select courses from the list offered for Erasmus+ students at each University to complete their profile and to meet and work with local students and Erasmus+ students. The list of courses is available at each partner University, e.g. [intranet.cvut.cz/incomers/erasmus-exchange/prospectus](http://intranet.cvut.cz/incomers/erasmus-exchange/prospectus).

### **2C19 INDUSTRIAL TRAINNING**

Three weeks practical training at the end of 2<sup>nd</sup> semester by industrial associated partner, at one of the member companies of European Convention for Constructional Steelwork (ECCS) or International Initiative for a Sustainable Built Environment (iiSBE).

### **3C20 DEGREE PROJECT**

The overall objective of the Degree project is that the student practices, develops and is able to apply theory and methods to solve problems relevant to a profession as Master of Science in Engineering. The theses will be focused e.g. to advanced design of RHS diagonal to open section truss, BIM in electricity pylons design, Comparison of service life of a riveted steel bridge under different operating conditions, and Influence of fire protection methods on sustainability of buildings.

### **3E21 ELECTIVE COURSE FROM LOCAL OFFER**

The students will have an opportunity to select courses from the list offered for Erasmus+ students at each University to complete their profile and to meet and work with local students and Erasmus+ students. The list of courses is available at each partner University, e.g. [intranet.cvut.cz/incomers/erasmus-exchange/prospectus](http://intranet.cvut.cz/incomers/erasmus-exchange/prospectus).