1. Course number and name

RB-S1-17-S50-6E, **Structural Design in Seismic Regions**

2. Credits and contact hours*

2 ECTS, lectures: 20 hours**, seminar: 10 hours**

3. Instructor's or course coordinator's name

Professor Jan Kubica PhD, DSc

4. Text book, title, author, and year

- Elnashai A.S., Di Sarno L.: Fundamental of Earthquake Engineering, Wiley & Sons, Ltd. Publication, 2008. ISBN 978-0-470-02483-6.
- Duggal S.K.: Earthquake-resistant design of structures, 2nd Ed., Oxford University Press, 2013. ISBN 978-0-19-808352-8.
- Bangash M.Y.H.: Earthquake Resistant Buildings – Dynamic Analyses, Numerical Computations, Codified Methods, Case Studies and Examples, Springer Verlag, 2011, ISBN 978-3-540-93817-0.

a. other supplemental materials

- EN 1998-1:2005 Eurocode 8: Design of structures for earthquake resistance - Part 1: General rules, seismic actions and rules for buildings.
- EN 1990:2002+A1:2005 (E): Eurocode 0: Basis of Structural Design.

5. Specific course information

a. brief description of the content of the course (catalog description)

Lectures:

(1) Seismic actions, (2) Behaviour of buildings in seismic regions, (3) Basic requirements for buildings situated on seismic terrains, (4) Compliance criteria, (5) Ground conditions, (6) Elastic response spectrum, (7) Determination of seismic loads, (8) Requirements in design of concrete buildings, (9) Requirements in design of masonry buildings, (10) Design by testing.

Seminar:

As part of the seminar, students in groups of 2-3 people analyze and present, based on the literature data, various types of protection of buildings and structures against dynamic and seismic influences.

b. prerequisites or co-requisites

Advanced structural mechanics. Basis of design of concrete, steel, timber and masonry structures.

c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program

Required.

6. Specific goals for the course

a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic

The student:

- has knowledge of general mechanics, strength of materials, theoretical models of materials and rules of the general shaping of the structure,
- knows the principles of mechanics and analysis of bar structures in the field of statics, dynamics and stability and knows selected computer programs supporting the analysis and design of a structure,
- knows the standards and guidelines for the design of buildings and their components,
- knows the principles of design and dimensioning of building construction elements made from metal, concrete, composite, timber and masonry,
- is able to evaluate and make a statement of loads acting on buildings,
- is able to correctly define computational models and computer analysis of structures and critically assess the results of this analysis.
- knows the rules of manufacturing and use, and is able to select construction materials,
- knows how to organize construction works according to the principles of technology and organization of civil engineering.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

K1A_W05, K1A_W06, K1A_U02, K1A_U04

7. Brief list of topics to be covered

1. Seismic actions: components of earthquake shock; PGA; seismic zones.
2. Behaviour of buildings in seismic regions: fundamental requirements; types of failures; structural and non-structural aspects.
3. Basic requirements for buildings situated on seismic terrains: structural simplicity; uniformity, symmetry and redundancy; bi-directional resistance and stiffness; torsional resistance and stiffness; diaphragmatic behavior at storey level.
4. Compliance criteria: general information; Ultimate limit state; Damage limitation state.
5. Ground conditions: identification of ground types; influence of geotechnical conditions; building-subsoil interaction.
6. Elastic response spectrum: general information; horizontal elastic response spectrum; vertical elastic response spectrum.
7. Determination of seismic loads: design ground displacement; design spectrum for elastic analysis; determination of the total horizontal shear (inertia) force; division of the total horizontal force into components acting on individual storeys of the building.
8. Requirements in design of concrete buildings: energy dissipation capacity and ductility classes; design criteria; safety verifications.
9. Requirements in design of masonry buildings: materials and bonding patterns; behavior factors; design criteria; rules for “Simple Masonry Buildings”.
10. Design by testing: approach given in Eurocode 0; determination of characteristic values based on experimental results.

*- Consultations were not included in the contact hours

**-per semester