



1. Course number and name

RB-S1-19-S49-66, **Advanced Structural Design - Selected Topics**

2. Credits and contact hours*

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

3. Instructor's or course coordinator's name

Rafał Krzywoń PhD

4. Text book, title, author, and year

- ACI Committee 207:: „ACI 207.2 R-07. Report on Thermal and Volume Change Effects on Cracking of Mass Concrete. ”. American Concrete Institute, 2007
- Bamforth PB: „CIRIA C660. Early-age thermal crack control in concrete.”. CIRIA, Classic House London 2007
- Japanese Concrete Institute : „Guidelines for Control of Cracking of Mass Concrete 2016”. JCI 2017
- fib Bulletin N° 46. Fire design of concrete structures - structural behaviour and assessment. State-of-art report (fib, July 2008)
- fib Bulletin N° 38. Fire design of concrete structures - materials, structures and modelling. State-of-art report (fib, April 2007)

a. other supplemental materials

- EN 1992-1-1 (2004) (English): Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
- EN 1992-1-1 (2004) (English): Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design

5. Specific course information

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

Lectures:

Thermal and shrinkage effects in reinforced concrete structures. Basic knowledge of thermo-mechanical modelling of concrete structures. Cracking causes in concrete structures. Basis of FEM modelling. FEM model optimization. E Fire resistance of concrete structures. Method of design - review of codes and calculation method. Testing methods. Material properties. Analysis. Examples of damage.

Seminar:

Shrinkage: description, types with definitions, calculation. Development of mechanical properties in concrete, calculation. Analytical methods: CIRIA C660. Description of the guidelines, calculation procedure for the early age wall structure. ACI. Description of the



guidelines, calculation procedure for the mass concrete structures. JCI. Description of the guidelines, calculation procedure for the early age wall structure. Reinforced concrete members subjected to fire: General description of the problem; fire resistance; properties of concrete and steel in fire conditions; examples of damages; thermal spalling, methods of protection. Tabulated data (simplified designing); the scope of PN-EN 1991-1-2; designing procedures; key steps of calculations; fire as an accidental design situation. 500oC Isotherm Method: description of the method, example of calculation from literature..

b. prerequisites or co-requisites

No prerequisites and additional requirements

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

Elective.

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 is able to:

- choose the proper method of structural analysis,
- choose the tools (analytical or numerical) to solve the problems of analysis and design of structures and construction works,
- selected computer programs supporting design decisions in construction..

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

K1A_W04, K1A_U12

7. Brief list of topics to be covered

1. Early age cracking of concrete (4 hours) – classification, types, causes of cracking.
2. Mass concrete (2 hours) – definition, examples, early age effects.
3. Early age effects design (2 hours) – stresses and cracking, design methods.
4. FEM modeling of concrete structures (4 hours) – finite elements, modeling of supports, loads, material modeling.
5. Cracking causes (4 hours) – typical causes, effects, prevention, repair methods.
6. Fire resistance of RC structures (4 hours) – design procedures, material properties, tabular methods, simplified methods fire scenarios microstructural changes, strains, mechanical properties, damage scenarios.

*- Consultations were not included in the contact hours

** -per semester