CIV-E2030 Experimental Methods in Building Materials L (5 cr)

Course Syllabus

21.04.2021 -31.05.2021

1. Course information

Status of the Course: Programme Name: Building Technology
Major studies; Construction and Maintenance
Level of the Course: Aalto Eng, Master and postgraduate degree course
Teachers in charge: Prof. Jouni Punkki
Staff Scientist, Fahim Al-Neshawy, D.Sc
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Teaching Period: Spring 2021 (Period V)
Registration for Courses: Registration to course using WebOodi - https://oodi.aalto.fi
Language of Instruction: English

2. Learning Outcomes

The goal of the course is to familiarize students with advanced experimental and characterization techniques commonly used in construction engineering.

Upon successful completion of the course, students will be able to:

1) Distinguish the basic conceptual, theoretical and analytical tools necessary for experimental testing of the building materials and structures.
2) Explore theoretical and practical information for the common non-destructive and destructive testing methods and techniques for building materials and structures.
3) Gain experience with and understanding of the advantages and applications of common experimental field and laboratory testing methods
4) Be able to plan a suitable experimental testing program for building materials and structures.

3. Course Content

The course covers the following topics:

- Physical nature of the material property or discontinuity to be inspected
- Visual inspection of structures
- Non-destructive testing techniques
- Destructive testing and evaluation techniques
- Microstructure analysis of building materials – Petrographic analysis, microscopy analyses and computed tomography
- Digital Image Processing (DIP) and Digital Image Correlation (DIC) in Civil Engineering

4. Teaching methods

The course includes the following teaching methods and activities:

1) Remote lectures using: https://aalto.zoom.us/
2) Writing academic reflection papers and presentations of the reflection papers using: https://aalto.zoom.us/
3) Final exam

4.1 Remote lectures

Lectures cover the content of the course. The course will be lectures via https://aalto.zoom.us/ and the lecture schedule is presented in Table 1. The schedule listed in the table is preliminary and may change during the course

Table 1. Course lectures – schedule (https://aalto.zoom.us/j/3971221916)

Date			Topics
Wed	21.04.2021	10:00 - 12:00	Introduction to experimental testing methods / basic statistical tools
Fri	23.04.2021	12:00 - 14:00	Structural condition assessment
Fri	23.04.2021	14:00 - 16:00	Introduction to reflection papers.
Wed	28.04.2021	10:00 - 12:00	Electrochemical methods
Fri	30.04.2021	12:00 - 14:00	Ground Penetrating Radar (GPR)
Fri	30.04.2021	14:00 - 16:00	Presentations of reflection paper - I
Wed	05.05.2021	10:00 - 12:00	Ultrasonic testing methods
Fri	07.05.2021	12:00 - 14:00	Moisture Inspection
Fri	07.05.2021	14:00 - 16:00	Presentations of reflection paper - II
Wed	12.05.2021	10:00 - 12:00	Destructive measurements on cores (Strength and Porosity)
Fri	14.05.2021	12:00 - 14:00	Digital Image Processing (DIP) and Correlation (DIC)
Fri	14.05.2021	14:00 - 16:00	Presentations of reflection paper - III
Wed	19.05.2021	10:00 - 12:00	Application of computed tomography (CT) in civil engineering
Fri	21.05.2021	12:00 - 14:00	Scanning electron microscope for the investigation of building materials
Fri	21.05.2021	14:00 - 16:00	Presentations of reflection paper - IV
Wed	26.05.2021	10:00 - 12:00	Thin section analysis (Petrography)
Fri	28.05.2021	12:00 - 14:00	Course Webinar - "Experience of non-destructive evaluation of reinforced concrete structures in Finland"
Fri	28.05.2021	14:00 - 16:00	
Mon	31.05.2021	9:00 - 12:00	Course examination

4.2 Academic reflection papers and weekly presentations

Writing academic reflection papers include reading of scientific (academic) articles related to the topic of weekly lectures and reflect the learning from the article. The reflection paper is maximum of three (3) pages reflecting the learning outcomes and discussion about the scientific article. Student groups are weekly presenting the reflection papers. The presentations should include at least one video clip about the equipment (or the topic) presented in the paper. Reflection papers (4 papers) are submitted weekly to myCourses. (Total points of the reflection papers and presentations = 30 points).

4.3 Final exam

The written exam (e-Exam via myCourses) includes 4 questions covering the course outcomes (total points for the exam are 70 points).

5. Course Workload

Student workload include attending the lectures, excursions, seminars, participating the group work, writing learning (reflecting) diaries and self-study work. The course ETCS/workload is presented in the following table.

Table 2. Course workload – estimated.

Student activities	Quantity	Duration (h)	Total (h)	% grade
Lectures				
Attending lectures	12	2	24	≈ 70%
Self-study: Independent work				
Independent reading	1	70	70	
Final examination	1	3	3	
Group assignments				≈ 30%
Presentations	4	2	8	
Reflecting reports – reading articles and writing Reflection paper	4	8	32	
Total workload (Hours)			137	100 %

6. Assessment methods and grading scale

The total points of the course are 100 and the grading scale for course is: 5 (highest); 4; 3; 2; 1 (lowest passing grade); 0 (failed). For passing the course, a minimum of (15) points are required for group work and a minimum of (35) points are required for the exam.

Table 3: Course grading

Total points	Grade
<50	0
50 to <60	1
60 to <70	2
70 to <80	3
80 to <90	4
90 to 100	5

7. Study Materials

- Recommended book for the course:
    - Jean-Paul Balayssac and Vincent Garnier, (2017). Non-Destructive Testing and Evaluation of Civil Engineering Structures. https://ebookcentral.proquest.com/lib/aalto-ebooks/detail.action?docID=5165459
        - Chapter 2. Ultrasonic Methods
        - Chapter 3. Electromagnetic Methods
        - Chapter 5. Electrochemical Methods
        - Chapter 9. Applications In Situ
        - Chapter 10. Methodological Guide
- Course handouts: include slides from lectures, explanatory notes, and additional readings.

8. Prerequisites

- CIV-E1010 Building Materials Technology
- CIV-E2020 Concrete Technology
- CIV-E2060 Production technology of concrete structures