**GEO-E1030 Structural Design of Roads**

A.Y. 2023-2024. Period II, Autumn 2023. October 23 to December 8, 2022

Course plan on October 25, 2023 *(Tentative schedule)*

**Content:** The course covers fundamental principles of road pavement systems in cold regions, including environmental effects, functional and structural evaluation of pavement performance, pavement materials and mechanics, frost protection, and flexible and rigid pavement design methods.

**Prerequisites:** Students should have basic knowledge of civil engineering construction materials and geotechnics, offered in the following courses: CIV-E1010 Building Materials Technology and GEO-E1020 Geotechnics.

**Course mode:** The course is offered in face-to-face mode mainly. If needed, online lecturing will be used, and students will be informed about it. The lecture will be recorded if recording tools are made available by Aalto University.

**Sessions:** Lectures are on Monday (12:15-14:00) and Friday (12:15-14:00), with the Friday session devoted to a diverse series of activities, such as lecturing, introducing the basic concepts of paving materials, reviewing the class topics, and assigning homework. Lectures will take place in room R5-265 on Monday and R3-255 on Friday. During week 48, there will be three lecture meetings: **Monday (14:15-16:00)** and **Wednesday (12:15-14:00)** will be shared with the **GEO-E2080** course in room **R5-265**.

Lectures include the presentation of content and some practical examples. Friday sessions provide a space to review the content and homework, ask questions, review weekly reading and guest lectures, and perform additional activities, including a student presentation. We recommend attending classes and exercises to learn the contents of the course effectively. Lectures will be recorded and uploaded to MyCourses/Panopto (if Aalto University makes recording tools available). A Zoom link to each session will be available to attend online (when in-person participation is not possible) starting from the Monday of the second week of the course. The links will be posted on MyCourses.

Your participation is essential to facilitate your learning progress. Please participate, discuss, and ask questions during the course. Changes in the plan are likely; you will be informed in the best timely manner possible. All efforts are being made for the class to work out smoothly!

# Intended learning outcomes\*

* *Explain* the concept of pavement environment, what kind of moisture and temperature regimes exist in pavement structures, and how they affect the system, particularly under frost conditions.
* *Assess* pavement performance in cold regions by *classifying* distresses in pavements, *identifying* their formation mechanisms, and *proposing* management and remediation alternatives.
* *Describe and compute* stress regimes in the pavement structure.
* *Integrate* the previous concepts into pavement analysis models to study pavement structures' critical stresses and strains.
* *Use* appropriate software for calculating stresses and strains at appropriate locations in the structures, i.e., multi-layered elastic analysis.
* *Design* a flexible pavement structure provided context by applying the appropriate material, traffic, environment, and other relevant considerations.
* *Get acquainted with* basic laboratory tests related to pavement engineering and materials and their associated output data, analysis, and relevant parameters obtained (e.g., determination of particle size distribution by dry/wet sieving and hydrometer methods; Proctor test to determine optimum water content).
* *Discuss and present professionally to peers/clients about road construction issues and pavement design and materials*.

\*The intended learning outcome might differ depending on the possible changes in the class schedule and organization during Period II

# Schedule (Tentative)

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| **Week** | **Date** | **Topic** |
| 43 | Mon 23.10. | **Lecture 1.** Introduction. Overview of pavements (ACF) |
| Fri 27.10. | **Review and activities**. Overview of pavements (ACF) and Lecture on paving materials I (ACF) |
| 44 | Mon 30.10. | **Lecture 2.** Pavement environment and performance (ACF) |
| Fri 03.11. | **Review and activities**. Pavement mechanics (KK, FZ, YS), **Student presentations** assigned, DL\* 01.12. |
| 45 | Mon 06.11. | **Lecture 3.** Pavement design in Finland (MTS) |
| Fri 10.11. | **Review and activities.** Lecture on paving materials II (ACF - Recorded), **Homework 1** assigned, DL 17.11.Explain HW01, (FZ & KK) |
| 46 | Mon 13.11. | **Lecture 4.** Pavement Design – Flexible and Rigid Pavement (ACF) |
| Fri 17.11. | **Review and activities**.Lecture on Paving Materials III (ACF)Topic presentation: (YS and QL) |
| 47 | Mon 20.11. | **Lecture 5.** Frost protection (HG) |
| Fri 24.11. | **Review and activities**. (ACF)Software + assigned final exam (take home) |
| 48 | Mon 27.11. | **Lecture 6\*.** Recycled and lightweight materials (LKT) |
| Wed 29.11. | **Lecture 7\*.** Earth construction (LKT) |
| Fri 01.12. | **Review and activities**. **Student presentations.** |
| 49 | Fri 08.12. | **Final exam due (take-home)** |

\* DL, Deadline date, at 23.55

**\*** Shared with GEO-E2080.

**Instructors**

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| ACF | Augusto Cannone Falchetto, Assistant Professor | augusto.cannonefalchetto@aalto.fi |
| LKT | Leena Korkiala-Tanttu, Associate Professor | leena.korkiala-tanttu@aalto.fi |
| HG | Henry Gustavsson, University Teacher | henry.gustavsson@aalto.fi |
| KK | Kateryna Krayushkina, Researcher | kateryna.krayushkina@aalto.fi |
| FZ | Fan Zhang, Doctoral Researcher | fan.3.zhang@aalto.fi |
| YS | Yuxuan Sun, Doctoral Researcher | yuxuan.sun@aalto.fi |
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| MTS | Marja-Terttu Sikiö, Destia | marja-terttu.sikio@destia.fi |

**Assessment**

The grade (100%) is composed of the final exam (FE) 40%, homework (**HW**) 30%, and student presentation (**SP**) 30%. Grading is 0-5. The Final exam grade must be at least 50% to pass the course. Exercises are valid for one year.

**Materials and resources**

* Lecture Notes
* Doré, G. & Zubeck, H.K. (2009). *Cold Regions Pavement Engineering*. McGraw-Hill; ASCE Press(main textbook)
* Huang, Y.H. (2004). *Pavement Analysis and Design*. Pearson, 2nd edition.

Loaning of textbooks at the Department of Civil Engineering is being arranged. More information will be provided during the first week.