**Geotechnics IV (Special foundations and underground structures)**

**Code: MFGTH34SS3-EN**

**ECTS Credit Points: 3**

Year, Semester: 4th year/1st semester

Number of teaching hours/week:

Lecture: **2**

Practice: **0**

**Prerequisites**: Geotechnics II (Earthworks): MFGTH32S04-EN and Geotechnics III. (Foundation Engineering)

**Topics:**

This is an introductory class to the design and the construction of the underground engineering structures, including embedded retaining wall, underground garage, and tunnels. Failure investigations in Geo technical Engineering and special foundations used for reenforcing damaged structures are also covered briefly.

By the end of this course, the student should have:

An overall knowledge and understanding of the design and the construction aspects of in-ground retaining structures.

Text: Lecture notes will be available.

**Bibliography:**

1. Károly Széchy (1966): The art of tunneling, Akadémiai Kiadó

2. Utsav Chandra Kalita (2011): Soil Mechanics & Foundation Engineering, PHI Learning Pvt. Ltd

3. Sahashi K. Gulhati, Sahashi K Gulhati Manoj Datta (2005): Geotechnical Engineering, Tata McGraw-Hill Education

**Schedule**

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| **1st week:**  **Lecture:** Failure investigations in Geo technical Engineering. Surveying and recording the damages, cracks. Planning of instrumentation, and analyzing their data.  **2nd week:**  **Lecture:** Recommendations and design for the restoration. Technologies used for reenforcing the foundation of a damaged building.  **3rd week:**  **Lecture:** In-ground retaining structures. Brief history of embedded retaining wall design. Embedded walls. Effects of soil/wall friction and adhesion.  **4th week:**  **Lecture:** Clay soils. Time-scale over which undrained conditions apply. Effect of high in situ lateral stress.  **5th week:**  **Lecture:** Calculation of bending moments and prop loads. Geostructural mechanism to estimate wall-movements. The effect of wall stiffness.  **6th week:**  **Lecture:** Analysis and design of shallow underground structures. Design and construction of underground engineering structures in urban area.  **7th week:**  Midterm Test | **8th week:**  **Lecture:** Introduction to tunnels. Tunnel construction. Bored tunnels in soft ground - method of construction.  **9th week:**  **Lecture:** Type of shield for tunneling. Stress changes near tunnels. Stability of tunnel headings for undrained and drained loading.  **10th week:**  **Lecture:** Stress analysis of a tunnel of circular cross-section. Collapse of tunnels in clay (short term total stress analysis). Collapse of tunnels - effective stress analysis  **11th week:**  **Lecture:** Ground movements due to tunneling. Load factor to limit ground movements.  **12th week:**  **Lecture:** Influence of water on tunnels. Environmental aspects of underground structures.  **13th week:**  **Lecture:** Design and construction of bored tunnels and pipes under existing road and railway lines. Supporting walls and presses.  **14th week:**  End of Semester Test  **15th week:**  Make-up tests (End of Semester). |

**Requirements**

Attendance: Participation in lectures is critical to successful completion of this course. More than 5 unexcused absences result in no completion of the course.

Completion of the course: D or higher grades for both tests. There is one make up test for each. Grading of tests:

Score Grade

0-60 (F) fail (1)

61-70 (D) pass (2)

71-80 (C) satisfactory (3)

81-90 (B) good (4)

91-100 (A) excellent (5)

Grading of the course:

Mid term Test 25%

End of semester Test 25%

Exam 50%

Verbal exam is taken at the end of the semester in the exam period. Students have to sign up for the scheduled exam minimum two days in advance in the Neptune.