

APPLIED SOIL MECHANICS - CE5300

Spring (Jan-May) 2021

Instructor: Chandrasekhar Annavarapu and Ramesh Kannan K

Slot: B

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Place: online

Course Objectives:

Design of earthen structures are complex due to the extensive spatial variations (changes in moisture, loading conditions etc.) that happens over the period of time. Considering various factors affecting the earth retaining structures is key for any design. This course is primarily designed for graduate students and the objectives are listed below.

- Introduce fundamental tenets of cavity expansion theory, earth pressure theories, arching and stability analysis
- Utilising the principles/theories thus introduced to design various types of earth retaining structures and slopes

Learning Outcomes:

At the end of the course, students will be aware of various theories, principles and techniques available for the design of earth retaining structures and slopes. Specific outcomes are listed below.

- Comprehending simple to advanced experimental techniques to quantify the geomaterial behaviour
- The unified framework and plasticity theory will help to reimagine the material behaviour in two dimensional and three dimensional space
- Predict the material response using classical behavioral/constitutive (elasto-plastic and critical state) models

Course Outline:

1. Introduction to earthen structures
2. Cavity expansion theory and its applications
3. Earth pressure theories
4. Retaining walls: Design of retaining walls and stability checks
5. Sheet pile walls/anchored bulkheads, open cuts
6. Theory of arching in soils and its applications in tunnels
7. Diaphragm walls, pre-stressed ground anchors

8. Slope stability: Methods of analysis
9. Slope protection and stabilisation
10. Earth dams and embankments: Choice of material, design of section, filters and drains
11. Numerical packages used for solving some earth pressure and slope stability problems

Office Hours: Through email or WhatsApp specifically on Thursdays.

References: The following are a restricted list of various interesting and useful books. Class notes and the books mentioned below will help you gain confidence in this course.

- Budhu, M. (2008). *Foundations and earth retaining structures*. John Wiley & Sons.
- Bowles, L. E. (1996). *Foundation analysis and design*. McGraw-hill.
- Clayton, C. R., Woods, R. I., Bond, A. J., & Milititsky, J. (2014). *Earth pressure and earth-retaining structures*. CRC press.
- Coduto, D. P. (1999). *Geotechnical engineering: principles and practices*.
- Das, B. M. (2015). *Principles of foundation engineering*. Cengage learning.
- Mair, R. J., & Wood, D. M. (2013). *Pressuremeter testing: methods and interpretation*. Elsevier.
- Murthy, V. N. S. (2002). *Geotechnical engineering: principles and practices of soil mechanics and foundation engineering*. CRC press.
- Powrie, W. (2018). *Soil mechanics: concepts and applications*. CRC Press.

Prerequisites: An undergraduate-level understanding of mechanics of geo-materials and basic geotechnical engineering is assumed.

Grading Policy: Assignments/tutorials (20%), Quiz 1 (20%), Quiz 2 (20%), Final exam (40%).

Course Policy:

- Please sign up for Moodle at IITM. We will confirm your enrolment for the course, then you will be able to see the course page.

Class Policy:

- Since this semester is through online mode. Lectures will be through videos and interactive online sessions.
- Please solve more problems other than the assignments and tutorials.
- Please complete the questionnaire within two days after every lecture which will be shared using google forms.

Academic Honesty: Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation.