



School of Civil and Environmental Engineering

Term 3, 2021

CVEN4204 GROUND IMPROVEMENT AND MONITORING TECHNIQUES

COURSE DETAILS

| | |
|------------------------|-----------------------------------|
| Units of Credit | 6 |
| Contact hours | 5 hours per week |
| Lecture | Mondays 1300 – 1600 Online |
| Workshop | Wednesday 1400 – 1600 Online |

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INFORMATION ABOUT THE COURSE

This course is a final year elective offered to all undergraduate Civil and Environmental Engineering students. It forms part of the undergraduate specialisation in Geotechnical Engineering. The course introduces the need for ground improvements and brief descriptions of the methods used. Detailed design procedures of ground improvement techniques such as compaction, vibro-floatation and stone column, preloading, soil nailing and reinforced earth, dewatering techniques, and deep soil mixing will be presented.

Problems relevant to the lectures will be solved each week in the workshops.

The assumed knowledge of the course is Soil Mechanics and Applied Geotechnical Engineering.

<https://www.handbook.unsw.edu.au/undergraduate/courses/2021/CVEN4204/>

HANDBOOK DESCRIPTION

Assessment of the suitability and design of stabilisation techniques for difficult foundation soils including instrumentation and application of observational techniques to geotechnical engineering. Topics covered will include: principles of the observational method, instrumentation, selected lectures on braced excavations, dewatering, grouting, underpinning, stone columns, vertical and horizontal drains, vacuum pumping, deep compaction, vibro floatation, lime stabilisation, reinforced earth and soil nailing.

OBJECTIVES

To provide the fundamentals of soil improvement techniques and observational methods in Geotechnical Engineering.

TEACHING STRATEGIES

The contents of this subject will be presented in a series of lectures, followed by examples/exercises. The lectures explain the theory and design recommendations. They tend to engage students in formal and informal discussions to broaden their understanding of different problems related to Geotechnical Engineering. Students are required to do extra research into the topics related to ground improvements not covered in the lecture.

An example of the approaches to learning is:

| | |
|--|---|
| Lectures | <ul style="list-style-type: none"> • Find out what you must learn • Follow worked examples • Hear announcements on course changes • Research on topics not covered in the student notes |
| Exercises | <ul style="list-style-type: none"> • Be guided by Lecturer • Practice solving set problems • Ask questions |
| Private Study | <ul style="list-style-type: none"> • Review lecture material and textbook • Participate in solving examples and discussions • Reflect on class problems and assignments • Consult with the Lecturer for their research topics |
| Assessments (examinations and research assignments) | <ul style="list-style-type: none"> • Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving • Demonstrate your ability to research new topics |

EXPECTED LEARNING OUTCOMES

By the end of the course successful students should:

| Learning Outcome | EA Stage 1 Competencies |
|--|----------------------------|
| 1. <i>Have an in-depth engagement with the problems of soft soils and methods of improving their behaviour.</i> | <i>PE1.1, PE1.2, PE1.3</i> |
| 2. <i>Be able to recommend a suitable ground improvement method for a range of problematic soils.</i> | <i>PE1.2, PE2.2, PE2.3</i> |
| 3. <i>Be able to analyse and design selected problems in soft grounds.</i> | <i>PE1.1, PE2.2, PE2.3</i> |
| 4. <i>Be able to perform research into the problems independently.</i> | <i>PE1.4, PE3.2, PE3.6</i> |
| 5. <i>Be able to design and analyse reinforced earth structures.</i> | <i>PE1.3, PE2.2, PE2.4</i> |
| 6. <i>Be able to list various types of instrumentation used in geotechnical engineering, explain how they function, contrast their advantages.</i> | <i>PE1.5, PE1.6, PE2.1</i> |

For each hour of contact, it is expected that students will need to put in at least 1.5 hours of private study.

COURSE PROGRAM

The table below shows the course program.

Term 3, 2020

| Date | Week | Lecture Topic |
|------------|------|--|
| 13/09/2021 | 1 | Introduction to ground improvement techniques and Review of geotechnical engineering principles |
| 20/09/2021 | 2 | In-situ testing, measurement and Pre-loading with and without drains (Workshop #1, Wednesday 1400-1600) |
| 27/09/2021 | 3 | Compaction and Dynamic compaction (Workshop #2, T Wednesday 1400-1600) |
| 04/10/2021 | 4 | Vibro compaction and Vibro replacement (pre-recorded lecture due to public holiday) (Workshop #3, Wednesday 1400-1600) |
| 11/10/2021 | 5 | Quiz #1 |
| 18/10/2021 | 6 | Non-teaching week |
| 25/10/2021 | 7 | Deep soil mixing techniques (Workshop #4, Wednesday 1400-1600) |
| 01/11/2021 | 8 | Project presentation |
| 08/11/2021 | 9 | Dewatering techniques and Reinforced earth walls (Workshop #5, Wednesday 1400-1600) |
| 15/11/2021 | 10 | Quiz #2 |

ASSESSMENT

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The assessment in this course consists of 2 quizzes (open book) each takes 1.5-2 hrs, one online test, covering all the different topics covered in the first 2 weeks of the course and one project presentation. **There is no final examination for this course.**

Details of each assessment component, the marks assigned to it set out below.

| | | |
|--------------|---------|-----|
| Online test: | Week 3 | 10% |
| Quiz #1: | Week 5 | 35% |
| Presentation | Week 8 | 20% |
| Quiz #2: | Week 10 | 35% |

Students are expected to start and finish each quiz within 2 hours (plus 20 minutes for submission/uploading).

There will not be any alternative quiz for those who miss one.

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The Lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

PENALTIES

Late work will be penalised at the rate of 10% per day after the due time and date have expired. This penalty rate is applicable to the online test.

ASSESSMENT OVERVIEW

| Item | Length | Weighting | Learning outcomes assessed | Assessment Criteria | Due date and submission requirements | Deadline for absolute fail | Marks returned |
|-------------------------|-------------|-----------|----------------------------|---------------------|--------------------------------------|----------------------------|----------------|
| 1. Online test | ~ 1 h | 10% | 1-3, 5-6 | Weeks 1 and 2, 3 | 04/10/2021 | NA | 08/10/2021 |
| 2. Quiz #1 | 1.5-2 h | 35% | 1-3, 5-6 | Weeks 2, 3 and 4 | Week 5 | Week 5 | Week 8 |
| 3. Project presentation | 10 min each | 20% | 1-3, 5-6 | NA | 01/11/2021 | Week 8 | Week 10 |
| 3. Quiz #2 | 1.5-2 h | 35% | 1-3, 5-6 | Weeks 7, 9 | Week 10 | Week 10 | End of Term |

Note 1: Attendance in all quizzes is compulsory.

Note 2: There will not be any alternative quiz for those who miss one.

RELEVANT RESOURCES

No textbooks are required as the topics covered in this course can be found in many books on ground improvement techniques. The following reference books may be useful for additional reading.

- Xanthakos, P.P., Abramson, L.W., and Bruce, D.A. (1994) Ground Control and Improvement, John Wiley.
- Hausmann, M.P. (1990) Engineering principles of ground modification, McGraw Hill.
- Moseley, M.P. and Kirsch, K. (2004) Ground improvement, 2nd edition, Spon Press.
- Dunncliff, J. (1988) Geotechnical instrumentation for monitoring field performance. Wiley.
- Institution of Civil Engineers (Great Britain) (1996) The observational method in geotechnical engineering. Thomas Telford.

Additional materials will be provided during the lectures or via Moodle.

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

<https://student.unsw.edu.au/dates>

PLAGIARISM

Beware! An assignment that includes plagiarized material will receive a 0% Fail and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

<https://student.unsw.edu.au/plagiarism>

ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism;
- Special Considerations: student.unsw.edu.au/special-consideration;
- General and Program-specific questions: [The Nucleus: Student Hub](#)
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC/SURVSOC/CEPCA

Refer to Academic Advice on the School website available at: <https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw>

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

| | Program Intended Learning Outcomes |
|--|---|
| PE1: Knowledge and Skill Base | PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals |
| | PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing |
| | PE1.3 In-depth understanding of specialist bodies of knowledge |
| | PE1.4 Discernment of knowledge development and research directions |
| | PE1.5 Knowledge of engineering design practice |
| | PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice |
| PE2: Engineering Application Ability | PE2.1 Application of established engineering methods to complex problem solving |
| | PE2.2 Fluent application of engineering techniques, tools and resources |
| | PE2.3 Application of systematic engineering synthesis and design processes |
| | PE2.4 Application of systematic approaches to the conduct and management of engineering projects |
| PE3: Professional and Personal Attributes | PE3.1 Ethical conduct and professional accountability |
| | PE3.2 Effective oral and written communication (professional and lay domains) |
| | PE3.3 Creative, innovative and pro-active demeanour |
| | PE3.4 Professional use and management of information |
| | PE3.5 Orderly management of self, and professional conduct |
| | PE3.6 Effective team membership and team leadership |