

| COURSE DETAILS                         |   | Unsaturated Soil Mechanics  | CVEN9531 | Term 2 - 2021 |
|--|---|---|----------|---------------|
| <b>Units of Credit</b>                 | 6   |   |          |               |
| <b>Lectures</b>                        | 17:00 – 19:00   | Online (Every second day from 23 June till 14 <sup>th</sup> July 2021)  |          |               |
| <b>Tutorials</b>                       | 19:00 – 21:00   | Online ((Every second day from 23 June till 14 <sup>th</sup> July 2021) |          |               |
| <b>Course Coordinator and Lecturer</b> | Professor Nasser Khalili<br>email: <a href="mailto:n.khalili@unsw.edu.au">n.khalili@unsw.edu.au</a><br>office: CVEN 513<br>phone: 9385 5074 |   |          |               |

### INFORMATION ABOUT THE COURSE

This is a stand-alone course on the fundamentals unsaturated soil mechanics.

### HANDBOOK DESCRIPTION

See link to virtual handbook:

<https://www.handbook.unsw.edu.au/postgraduate/courses/2021/CVEN9531>

### OBJECTIVES

The course aims to have students gain the following attributes:

- 1) Knowledge of the fundamentals of theoretical and applied unsaturated soil mechanics as they may be encountered by geotechnical engineers
- 2) Ability to assess data and reports presented to them by specialists in the area of unsaturated soil mechanics and geotechnical engineering
- 3) Capacity for analytical and critical thinking and for creative problem solving
- 4) Ability to engage independent and reflective thinking
- 5) Skills for complex multi disciplinary work

## TEACHING STRATEGIES

The course will involve formal lectures and tutorial delivered in a remote mode.

|   |   |
|---|---|
| <b>Lecturers and Private Study</b>                                    | <ul style="list-style-type: none"><li>• Review lecture material and textbook</li><li>• Do set problems and assignments</li><li>• Join discussions in the class</li><li>• Reflect on class problems and assignments</li><li>• Review material covered in each day on the same night.</li></ul> |
| <b>Workshops</b>  | <ul style="list-style-type: none"><li>• Be guided by Lecturer</li><li>• Review worked problems</li><li>• Ask questions</li></ul>  |
| <b>Assessments (Final exam and hand-in tutorials and assignments)</b> | <ul style="list-style-type: none"><li>• Demonstrate your knowledge and skills</li><li>• Demonstrate higher understanding and problem solving</li></ul>  |

| EXPECTED LEARNING OUTCOMES |   | EA Stage 1 Competencies   |
|----------------------------|---|---------------------------|
| 1.                         | An in-depth knowledge of geomechanics in its inter-disciplinary context                 | PE1.1, PE1.2 PE1.5, PE2.3 |
| 2.                         | Improved capacity for analytical and critical thinking and for creative problem solving | PE1.2, PE2.2, PE2.3       |
| 3.                         | Ability to engage independent and reflective learning                                   | PE1.2, PE2.2, PE2.3       |
| 4.                         | Skills for collaborative and multi-disciplinary work                                    | PE2.2, PE2.3, PE3.3       |
| 5.                         | A respect for ethical practice and social responsibility                                | PE3.1, PE1.5, PE3.3       |
| 6.                         | Skills for effective engineering decision making  | PE2.1, PE2.2, PE2.3       |

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

## ASSESSMENT

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The Final Examination is worth 50% of the Final Mark if hand-in tutorials and assignments are included, and 100% if hand-in tutorials are not included. The hand-in tutorials and assignments are worth 50% of the Final Mark if included. A mark of at least 40% in the final examination is required before hand-in tutorials are included in the final mark. The formal exam scripts will not be returned.

All hand-in tutorials and assignments will be marked and returned to students. The aim is to provide feedback on the correctness of the approaches and the solutions presented, and re-enforce independent learning. The tutorials and assignments are core components of the course and represent individual work. They

will be assessed on the basis of technical accuracy of calculations and evidence of engineering judgment with assumptions and problem simplification. The tutorials and assignments will cover all aspects of the material covered in the course.

The final examination is included as the course learning outcomes include a significant level of technical learning that can be effectively and objectively assessed in an exam environment. The examination is designed to align with the learning outcomes and competencies derived from the course. The final examination is **open book** and is of **two-hour duration**.

Supplementary Examinations for Term 2 2021 will be held on Monday 06<sup>th</sup> September – Friday 10<sup>th</sup> September 2021 (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not make any personal or travel arrangements during this period.

| <b>Item</b>                          | <b>Length</b> | <b>Weighting</b> | <b>Learning outcomes assessed</b>   | <b>Assessment Criteria</b><br><i>(this needs to explicitly describe what students are expected to demonstrate in the task)</i> | <b>Due date and submission requirements</b> | <b>Deadline for absolute fail</b>      | <b>Marks returned</b>                              |
|--------------------------------------|---------------|------------------|-------------------------------------|--|---|--|--|
| 1. Hand-in tutorials and assignments |               | 50%              | PE1.1, 1.2, 1.3, 2.1, 2.3           | <i>Appropriate engineering solution</i>  | <i>Four weeks before the final exam</i>     | <i>Two weeks before the final exam</i> | <i>Two weeks after submission of the tutorials</i> |
| 2. Final Exam                        |               | 50%              | PE1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.3 | <i>Appropriate engineering solution</i>  | As scheduled                                |  |  |

## **COURSE PROGRAM**

A table of lectures and workshops or practical class topics for each week, indicating the name of lecturer involved (where multiple lecturers teaching in course), online activities, such as discussion forums, and relevant readings from textbook and other reference material identified for the course.

### **Term 2 2021**

| <b>Date</b>              | <b>Topic</b>            | <b>Lecture Content</b>  |
|--------------------------|-------------------------|---|
| 23/6/2021<br>(Lecture 1) | <b>Introduction</b>     | Typical examples of unsaturated soils and basic definitions   |
| 25/6/2021<br>(Lecture 2) | <b>Effective stress</b> | A detailed discussion on the validity of effective stress principle and its application to unsaturated soils              |
| 28/6/2021<br>(Lecture 3) | <b>Shear Strength</b>   | Methods of strength determination in unsaturated soils including two stress state approach and effective stress approach. |

|                           |  |  |
|---------------------------|--|--|
| 30/6/2020<br>(Lecture 4)  | <b>Shear Strength</b>                          | Shear Strength Continued   |
| 2/7/2021<br>(Lecture 5)   | <b>Volume change</b>                           | Methods of volume change analysis including collapse upon wetting and shrink swell analysis. |
| 5/7/2021<br>(Lecture 6)   | <b>Seepage</b>                                 | Methods of seepage analysis including surface infiltration                                   |
| 7/7/2020<br>(Lecture 7)   | <b>Applied unsaturated soil mechanics</b>      | Application of unsaturated soils to retaining wall design, pile design and bearing capacity  |
| 9/7/2020<br>(Lecture 8)   | <b>Soil water retention curve</b>              | Discussion of pitfalls of interpreting SWRC  |
| 12/7/2020<br>(Lecture 9)  | <b>Suction measurement and in situ testing</b> | Various techniques for measurement of suction  |
| 14/7/2020<br>(Lecture 10) | <b>Advanced topics in unsaturated soils</b>    | Consolidation, pore pressure parameters, plasticity  |

### Hand-in Tutorials/Assignments

All hand-in tutorials and assignments are due two weeks before the scheduled date for the final exam. A penalty of 10% will apply for each day of late submission. Tutorials and Assignments handed in more than 10 days late will not be considered in the assessment. There will be a total of one (1) assignment and eight (8) tutorials. *All hand-in assignments and tutorials will be marked and returned to students. The aim is to provide feedback on the correctness of the approaches and the solutions presented, and re-enforce independent learning. The assignments are a core component of the course and represent individual work. They will be assessed on the basis of technical accuracy of calculations and evidence of good engineering judgment with assumptions.*

## RELEVANT RESOURCES

This course has no specific text book. Some of the references are:

- Unsaturated Soil Mechanics in Engineering Practice (Fredlund et al, 2012)
- Unsaturated Soil Mechanics (Lu, 2004)
- Unsaturated Soil Mechanics in Geotechnical Practice (Blight, 2013)

## DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

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

## PLAGIARISM

Beware! An assignment that includes plagiarised 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](https://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 Key Contacts on the Faculty website available at:

<https://www.unsw.edu.au/engineering/student-life/student-resources/key-contacts>

## Appendix A: Engineers Australia (EA) Competencies

### Stage 1 Competencies for Professional Engineers

|  | <b>Program Intended Learning Outcomes</b>   |
|--|---|
| <b>PE1: Knowledge and Skill Base</b>             | 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 |
| <b>PE2: Engineering Application Ability</b>      | 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      |
| <b>PE3: Professional and Personal Attributes</b> | 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   |