USC

Course Outline

Code: ENG432
Title: Advanced Soil Mechanics

School of: Science & Engineering
Teaching Session: Semester 2
Year: 2019
Course Coordinator: Dr Adrian McCallum Email: amccallu@usc.edu.au
Course Moderator: Dr Helen Fairweather

Please go to the USC website for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1 Description

Without solid foundations, all built structures are in danger of collapse. This practical course uses a systems design cycle approach to initially inspect and test soil properties. Based on these results, you learn how to design, construct, test and assess the performance of structures within and upon the soil. It is a problem-based learning course where you work individually and in groups to self-direct your learning. Over a semester you conduct a field-based geotechnical project for a 'client' to whom you report progress. The project is complemented by laboratory testing and theory.

1.2 Course topics

◦ Significance of geotechnical engineering
◦ Determining soil strength
◦ Lateral earth pressures
◦ Retaining walls
◦ Shallow & deep foundations
◦ Slope failure
◦ Ground improvement
◦ Earthquakes & liquefaction
◦ Critical State Soil Mechanics
◦ Other methods

2. What level is this course?

400 level Graduate - Independent application of graduate knowledge and skills. Meets AQF and professional requirements. May require pre-requisites and developing level knowledge/skills. Normally taken in the 4th year of an undergraduate program

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

Specific Learning Outcomes On successful completion of this course you should be able to:	**Assessment Tasks** You will be assessed on the learning outcome in task/s:	**Graduate Qualities or Professional Standards mapping** Completing these tasks successfully will contribute to you becoming:
1. Apply current practical and theoretical knowledge of *fundamental* geotechnical engineering principles, concepts and technologies that relate to building structures on soil in regional contexts	Task 1: Project plan Task 2: Field/laboratory reports Task 3: Individual presentation Task 4: Final project report	Knowledgeable
2. Solve complex theoretical and technical engineering problems by taking a *whole systems design cycle approach* to: • select and use established engineering methods, techniques, tools and resources • determine inherent parameters of materials, components and systems by safely carrying out testing and experiments, collecting data, and dealing with sources of error • interpret, critically analyse, evaluate and synthesise current and emerging information to inform decision-making • develop and/or model and justify solutions, taking into account potential outcomes, constraints, risks and research-based evidence	Task 2: Field/laboratory reports Task 3: Individual presentation Task 4: Final project report	Critical and creative thinkers Engaged
3. Plan, design, construct, test and assess an engineering structure on soil under supervision.	Task 1: Project plan Task 2: Field/laboratory reports Task 4: Final project report	Creative and critical thinkers.
4.Communicate to a 'Project Manager' in different modes (written, oral and visual) and specified industry formats (e.g. reports, diagrams, client presentations)	Task 1: Project plan Task 2: Field/laboratory reports Task 3: Individual presentation Task 4: Final project report	Empowered
5.Act professionally by: • functioning autonomously and in teams • adhering to the engineering code of ethics • demonstrating *fundamental* management skills	Task 1: Project plan Task 2: Field/laboratory reports	Ethical

5. Am I eligible to enrol in this course?

Refer to the USC Glossary of terms for definitions of "pre-requisites, co-requisites and anti-requisites".

5.1 Enrolment restrictions

Enrolled in Program SC410, SC425, AB101, UU301, UU302 or XU301

5.2 Pre-requisites

ENG312

5.3 Co-requisites
Nil

5.4 Anti-requisites
CIV3403 (USQ)

5.5 Specific assumed prior knowledge and skills (where applicable)
Nil

6. How am I going to be assessed?

6.1 Grading scale
Standard – High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL)

Background to the assessment tasks
This course involves your management of a semester-long practical field-based geotechnical engineering construction project. This will simulate the challenges of being a Project Engineer (PE) working with others to meet the expectations of your Project Manager (PM) (lecturer) and ultimately the client. You are given the client's broad specifications for the project, requiring you to design, construct, test and assess a structure built on soil. Your group of PEs will manage the scope of the project and your first task is to produce a Project Plan outlining how you will successfully manage the project to completion. On a weekly basis you will report to the PM with: a progress update (tasks achieved in the week), future-works (tasks for the following week), results of any field/laboratory testing, and any impediments to progress with suggested solutions. As the project nears completion, you brief the 'client' on a selected technical aspect of the project and prepare your Final Project Report. The PM will give you regular feedback on your progress and assess your work on behalf of the 'client' (additional task information is below). This course fosters your independence and ability to work in a team and nurtures your project management, communication and problem-solving skills. Through successful completion of these tasks and effective management of your project, you should pass the course thus preparing you for your 4th year Honours engineering project.

6.2 Details of early feedback on progress
Formative feedback is delivered on a weekly basis after weekly in-class presentations. Both verbal and written feedback is also provided upon the receipt of each weekly submission.

6.3 Assessment tasks

Task No.	Assessment Tasks	Individual or Group	Weighting %	What is the duration/length?	When should I submit?	Where should I submit it?
1	Weekly tutorial questions	Individual	40%	4 short answer / calculation questions (500 words or equivalent) issued from weeks 2 through 11; best 4 from 10 will be counted	Before the lecture of the following week	Blackboard
2	Verbal 'Client' briefing – Project Plan	Individual	20%	15 minutes with visual media	Week 7	In class then uploaded into Blackboard
3	Final project report	Group	40%	5000 words or equivalent (e.g. diagrams) +/- 10%	Friday Week 16	Blackboard

Assessment Task 1: Weekly individual tutorial questions contained within a report format.

Goal:	Preparation of technical reports is an essential skill for competent Engineers. This assessment is designed for you to develop and **receive summative feedback** on your current practical and theoretical geotechnical knowledge to solve complex technical engineering problems related to the project. This task directly assists you to be successful in Task 3.
Product:	Technical Report addressing tutorial questions, completed using the suggested template provided.
Format:	Individually you will prepare a short weekly Technical Report that presents solutions and analyses of questions posed to address the key themes of each week. Implications of the results for the project should be discussed. The PM examines these reports and provides feedback. You are to act on any feedback and incorporate necessary changes into future submissions.
Criteria:	1. Apply current geotechnical knowledge to solve complex engineering problems by taking a *whole systems design cycle approach* to test and assess an engineering structure on soil *according to your project plan* • select and use established engineering methods, techniques, tools and resources • determine inherent parameters of materials, components and systems by *safely* carrying out testing and experiments, collecting data, and dealing with sources of error • interpret, critically analyse, evaluate and synthesise current and emerging information to inform decision-making 2. Communicate to a 'Project Manager' in the form of written technical reports • adhere to prescribed report structure and word count • English expression and conventions • terminology, nomenclature and units • adhere to established conventions for presentation of raw and processed data and instrumental results • referencing conventions 3. Act professionally by: • adhering to the engineering code of ethics in reporting and interpreting results • demonstrating *fundamental* management skills

Assessment Task 2: Verbal 'Client' briefing - Project plan

Goal:	Individually apply current practical and theoretical geotechnical knowledge to follow the necessary steps to plan and design an achievable project for a 'client'.
Product:	A 'client' briefing re. Project Plan plus one particular technical aspect of the project.
Format:	This task is an individual 15 minute presentation in the form of a briefing to the 'client' for whom you are carrying out the project, in front of an audience of your engineering peers. It includes a question and answer session. You choose visual media to suit the way you wish to communicate, e.g. film, poster, power point, etc. This will be uploaded to Blackboard on completion of the presentation. Assume the 'client' has limited engineering knowledge, so you will need to restrict the use of terms to the essential ones and define them, as well as interpret data and diagrams for the 'client'. You will present the project plan that you developed in groups of 3-5 (depending on the class size). Outline how you propose to achieve all assessment and practical goals by the end of week 13. Your Project Plan includes the standard industry requirements: scope definition, aim and proposed outputs, work and reporting schedules, resources, budget, milestones, risk assessment, organisational structure. Additionally, you will briefly focus on one particular aspect of the envisaged investigation.
Criteria:	1. Apply current practical and theoretical geotechnical knowledge to follow the necessary steps in planning and designing an achievable project for a 'client'. • components of the plan are completed with explanations where necessary, including work schedule that shows proposed contributions from group members • plan is justified as achievable in terms of scope, resources, budget and risk

	• necessary terminology/technical terms explained 2. communicate to the 'Project Manager' in the form of a written project plan • structure (prescribed format with headings) and adherence to word limit • English expression • adherence to conventions for presenting schedules, tables of resources, budget 3.act professionally by: • functioning in teams *to plan the project* • adhering to the engineering code of ethics *in making realistic estimates of budget and risk* • demonstrating *how you propose to manage the project* You are awarded an individual grade. Marks will be recorded and made available to students through Gradebook.

Assessment Task 3: Project completion report

Goal:	To report on the completion of the project in relation to the plan for the design, construction, testing and assessment of an engineering structure on soil under supervision.
Product:	Project completion report
Format:	The individual report of 2000 words or equivalent +/- 10% (including diagrams) is to the PM. It is weighted 40% and encapsulates the aims, progression and outcomes of the project in relation to the project plan. It comprises: • A synopsis of the project that follows typical industry requirements: – project aims – investigations and testing carried-out on the soil and built structure – results of any investigations – discussion & implications of results – conclusions in relation to aims, and recommendations. • Appendix 1: the Project plan showing, via track changes, that you have amended it following feedback from, and grading, by the PM • Appendix 2: the five field/laboratory reports each incorporating any amendments following feedback from, and review by, the PM
Criteria:	1. Apply current practical and theoretical geotechnical knowledge and the *whole systems design cycle approach* to report on: • project aims • how you solved the complex problems related to constructing, testing and assessing a structure *on soil in a regional context* – summary of investigations, testing & results – discussion & implications of results • conclusions – a judgment about achievability of the original project plan and aims • justify recommendations for future similar projects 2. Communicate to a 'Project Manager' in the form of a written report • adhere to prescribed synopsis format and word count • English expression and conventions • terminology, nomenclature and units • adhere to established conventions for presenting a summary of results 3. Act professionally *to complete the report* by: • functioning autonomously • adhering to the engineering code of ethics The appendices provide the evidence to support your project completion report. They are not re-graded for this task. However, if they are omitted or do not demonstrate incorporation of feedback from the PM via track changes or other means, your final grade for this task may be reduced.

7. What are the course activities?

7.1 Directed study hours

The directed study hours listed here are a portion of the workload for this course. A 12 unit course it will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

Location: Specific Campus(es) or online:	**Directed study hours for location:**
USC Sunshine Coast	Lecture: 1hr per week Lab: 2 hrs per week

7.2 Course content

Week # / Module #	**What key concepts/content will I learn?**
1	Introduction to course outline and geotechnical engineering.
2	Site shear strength assessment via field, laboratory and analytical means
3	Site shear strength assessment via field, laboratory and analytical means (continued + retaining wall construction)
4	Lateral earth pressure assessment via field, laboratory and analytical means
5	Lateral earth pressure assessment via field, laboratory and analytical means (continued; including retaining wall assessment)
6	Shallow foundations; construction and assessment of both in field and laboratory
7	Deep foundations; construction and assessment of both in field and laboratory
8	Slope failure
9	Slope failure; simulation of in the field and modelled using software; builds on field trip
10	Ground improvement; installation of geotextile reinforcing and testing in the field and using software
11	Earthquakes & liquefaction; impacts of vibration on structures such as retaining walls and possible mitigation
12	Critical State Soil Mechanics
13	Project review and Q and A

8. What resources do I need to undertake this course?

Please note that course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Blackboard site. Please log in as soon as possible.

8.1 Prescribed text(s)

Please note that access to the resource(s) listed below or similar may be useful:

Author	**Year**	**Title**	**Publisher**
Sivakugan, N. & Das, B.	2010	Geotechnical Engineering – A practical problem solving approach.	J. Ross Publishing, USA

8.2 Specific requirements

Enclosed footwear is required whenever working within the engineering laboratory. Enclosed footwear, high-visibility vest, hat and sunscreen are required for any field work on or off campus.

9. Risk management

Students will carry out their own risk assessments as necessary for any laboratory or field experiments.

It is your responsibility as a student to review course material, search online, discuss with lecturers and peers, and understand the health and safety risks associated with your specific course of study. It is also your responsibility to familiarise yourself with the University's general health and safety principles by reviewing the online Health Safety and Wellbeing training module for students, and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1 Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

10.2 Assessment: Additional requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

a) The final mark is in the percentage range 47% to 49.4%
b) The course is graded using the Standard Grading scale
c) You have not failed an assessment task in the course due to academic misconduct

10.3 Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate:

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task.
- 10% (of the assessment task's identified value) for the third day
- 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.
- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.
To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

10.4 Study help

In the first instance, you should contact your tutor, then the Course Coordinator. Additional assistance is provided to all students through Academic Skills Advisers. To book an appointment or find a drop-in session go to Student Hub.

Contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au

10.5 Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website:
http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.6 General Enquiries

In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC South Bank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **USC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **USC Fraser Coast -** Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **USC Caboolture -** Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au