Description: Geotechnical Engineering

<table>
<thead>
<tr>
<th>Subject</th>
<th>Cat-Nbr</th>
<th>Class</th>
<th>Term</th>
<th>Mode</th>
<th>Units</th>
<th>Campus</th>
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<tbody>
<tr>
<td>CIV</td>
<td>3403</td>
<td>24596</td>
<td>2, 2003</td>
<td>ONC</td>
<td>1.00</td>
<td>TW MBA</td>
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Academic Group: FOENS
Academic Org: FOES03
HECS Band: 2
ASCED Code: 030911

STAFFING
Examiner: Richard Merifield
Moderator: Mark Porter

PRE-REQUISITES
Pre-requisite: CIV2402

OTHER-REQUISITES
Prerequisites 70455

SYNOPSIS
The material in this course will be concerned with design and stability problems in soil and retaining structures and foundation engineering, using soil mechanics and principles. It will also allow an understanding of the basic principles of rock mechanics. Stability problems will be considered in plane strain conditions. Similarly design and analysis of foundations will be approached in a two dimensional space. Rock Mechanics portion of the course will include physical and mechanical properties of rocks, failure criteria, models for rock discontinuities and related testing procedures. An introduction to stability problems in rock mechanics is also included.

OBJECTIVES
On completion of this course, students should be able to:

- determine bearing capacity and analyse slope stability both with complicated boundary conditions that are not solvable by traditional methods;
- analyse slope stability in dams and embankments using semi numerical methods;
- understand design procedures and practical aspects of soil improvement under foundations and soil structures;
- design of rigid and flexible retaining structures and in particular application of advanced methods of sheet piling design;
- design and analysis of rigid and elastic foundations;
- design and analysis of pile foundation;
- understand the engineering behaviour of rocks in relation to rock deformation, fractures and failure criterions, and application of this knowledge in design;
- apply computer methods to stability problems and design aspects of geotechnical engineering.

**TOPICS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Weighting (%)</th>
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<tbody>
<tr>
<td>1. SHEAR STRENGTH OF SOILS AND FAILURE CRITERIA The Mohr circle of stresses, Coulumb's failure criterion, Mohr Coulumb failure criteria, review of strength tests.</td>
<td>6.00</td>
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<tr>
<td>2. UPPER BOUND THEOREM AND ITS APPLICATION TO SOIL STRUCTURES Basic assumptions, upper bound mechanisms for plane collapse of foundations, slopes and retaining walls, recommendations for a numerical approach.</td>
<td>8.00</td>
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<tr>
<td>3. STABILITY OF SLOPES Slice method, total stress analysis, effective stress analysis, stability based on planar failure surfaces, introduction to non circular failure surfaces.</td>
<td>10.00</td>
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<tr>
<td>4. LATERAL EARTH PRESSURE AND RETAINING WALLS Introduction to lateral earth pressure and retaining walls, Rankine's method, Coulumb's wedge analysis, stability of gravity retaining walls, lateral pressures due to surcharge loads, computer solution of trial wedge.</td>
<td>10.00</td>
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<tr>
<td>5. FLEXIBLE RETAINING STRUCTURES Design of cantilever sheet piles, design of anchored sheetpiles, design of anchors, design of braced sheeting.</td>
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<td>6. DESIGN OF RIGID FOUNDATIONS Spread footing design, mat foundation design, settlement of rigid foundation.</td>
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<tr>
<td>7. DESIGN OF ELASTIC FOUNDATIONS The concept of subgrade reaction modulus, classical solutions, introduction to numerical solutions.</td>
<td>10.00</td>
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<tr>
<td>8. PILE FOUNDATION Single pile: static capacity, dynamic analysis, pile foundation. Groups: pile group considerations, stress distribution, settlement analysis, design of pile foundation using numerical methods.</td>
<td>12.00</td>
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<tr>
<td>9. ENGINEERING PROPERTIES OF ROCKS AND RELATED TESTING PROCEDURES Strength tests, physical properties of rocks, discontinuities in rocks.</td>
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<tr>
<td>10. DEFORMATION PROPERTIES OF ROCKS Stress and strain, rock deformation in compression, mechanics of micro and macro fractures.</td>
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</table>
11. ROCK STRENGTH AND FAILURE CRITERIA Rock strength criterion, failure criterion, the critical state concept, triaxial testing, axial and volumetric strain data.

12. DISCONTINUITIES IN ROCK MASSES Discontinuity measurement, shear resistance of a rock containing a discontinuity, shear resistance of a discontinuity, models for rock discontinuities.

13. STABILITY PROBLEMS IN ROCK MECHANICS Stability of a circular tunnel, slope stability for wedge failure, bearing capacity theory in Rock Mechanics Note: Design Projects Students will be given two design assignments related to stability problems and foundation analysis. Students will be required to make considerable use of computer packages. The loading for these projects is included in the student workload requirements.

TEXT and MATERIALS required to be PURCHASED or ACCESSSED:
Books can be ordered by fax or telephone. For costs and further details use the 'Book Search' facility at http://bookshop.usq.edu.au by entering the author or title of the text.


REFERENCE MATERIALS
Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.


STUDENT WORKLOAD REQUIREMENTS

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>HOURS</th>
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<tbody>
<tr>
<td>Directed Study</td>
<td>20</td>
</tr>
<tr>
<td>Examinations</td>
<td>3</td>
</tr>
<tr>
<td>Lectures</td>
<td>28</td>
</tr>
<tr>
<td>Private Study</td>
<td>56</td>
</tr>
<tr>
<td>Report Writing</td>
<td>20</td>
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<tr>
<td>Tutorial</td>
<td>28</td>
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ASSESSMENT DETAILS

<table>
<thead>
<tr>
<th>Description</th>
<th>Marks Out of</th>
<th>Wtg(%)</th>
<th>Required</th>
<th>Due Date</th>
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<tbody>
<tr>
<td>ASSIGNMENT 1</td>
<td>150.00</td>
<td>15.00</td>
<td>Y</td>
<td>12 Sep 2003</td>
</tr>
<tr>
<td>ASSIGNMENT 2</td>
<td>150.00</td>
<td>15.00</td>
<td>Y</td>
<td>17 Oct 2003</td>
</tr>
<tr>
<td>3 HOUR OPEN EXAMINATION</td>
<td>700.00</td>
<td>70.00</td>
<td>Y</td>
<td>END S2</td>
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NOTES:
- Student Administration will advise students of the dates of their examinations during the semester.

IMPORTANT ASSESSMENT INFORMATION

1. Attendance requirements:
   It is the students' responsibility to attend and participate appropriately in all activities (such as lectures, tutorials, laboratories and practical work) scheduled for them, and to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

2. Requirements for students to complete each assessment item satisfactorily:
   To complete each of the assessment items satisfactorily, students must obtain at least 50% of the marks available (or at least a grade of C-) for each assessment item.

3. Penalties for late submission of required work:
   If students submit assignments after the due date without prior approval then a penalty of 20% of the total marks available for the assignment will apply for each working day late.

4. Requirements for student to be awarded a passing grade in the course:
   To be assured of receiving a passing grade a student must attempt all of the summative assessment items, achieve at least 50% in the examination, achieve an aggregated mark of at least 40% in the total marks allocated for the assignments, and at least 50% of the available weighted marks for the summative assessment items.

5. Method used to combine assessment results to attain final grade:
   The final grades for students will be assigned on the basis of the weighted aggregate of the marks (or grades) obtained for each of the summative assessment items in the course.

6. Examination information:
   In an Open Examination, candidates may have access to any material during the examination except the following: electronic communication devices, bulky materials, devices requiring mains power and material likely to disturb other students.

7. Examination period when Deferred/Supplementary examinations will be held:
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.

8 University Regulations:
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL http://www.usq.edu.au/SECARIAT/calendar/Part5/ or in the printed version of the current USQ Handbook.

ASSESSMENT NOTES

1 The due date for an assignment is the date by which a student must despatch the assignment to the USQ. The onus is on the student to provide proof of the despatch date, if requested by the Examiner.

2 Students must retain a copy of each item submitted for assessment. This must be despatched to USQ within 24 hours if required by the Examiner.

3 In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances.

4 The Faculty will normally only accept assessments that have been written, typed or printed on paper-based media.

5 The Faculty will NOT accept submission of assignments by facsimile.

6 Students who do not have regular access to postal services or who are otherwise disadvantaged by these regulations may be given special consideration. They should contact the examiner of the course to negotiate such special arrangements.

7 In the event that a due date for an assignment falls on a local public holiday in their area, such as a Show holiday, the due date for the assignment will be the next day. Students are to note on the assignment cover the date of the public holiday for the Examiner's convenience.

8 Students who have undertaken all of the required assessments in a course but who have failed to meet some of the specified objectives of a course within the normally prescribed time may be awarded the temporary grade: IM (Incomplete - Make up). An IM grade will only be awarded when, in the opinion of the examiner, a student will be able to achieve the remaining objectives of the course after a period of non-directed personal study.

9 Students who, for medical, family/personal, or employment-related reasons, are unable to complete an assignment or to sit for an examination at the scheduled time may apply to defer an assessment in a course. Such a request must be accompanied by appropriate supporting documentation. One of the following temporary grades may be awarded IDS (Incomplete - Deferred Examination); IDM (Incomplete Deferred Make-up); IDB (Incomplete - Both Deferred Examination and Deferred Make-up).

10 This is a communication benchmark course and a major component of the assessment of this course will be associated with the demonstration of communication skills.
OTHER REQUIREMENTS

1 Students will require access to e-mail and internet access to USQConnect for this course.