



The University of Southern Queensland

Course specification

The current and official versions of the course specifications are available on the web at <http://www.usq.edu.au/coursespecification/current>.
Please consult the web for updates that may occur during the year.

Description: Agricultural Soil Mechanics

| Subject | Cat-nbr | Class | Term | Mode | Units | Campus |
|---------|---------|-------|---------|------|-------|-----------|
| AGR | 4305 | 74378 | 1, 2008 | ONC | 1.00 | Toowoomba |

| | |
|-----------------------------------|--------|
| Academic group: | FOENS |
| Academic org: | FOES03 |
| Student contribution band: | 2 |
| ASCED code: | 039999 |

STAFFING

Examiner: Guangnan Chen
Moderator: Jim Shiau

SYNOPSIS

Agriculture machinery interacts with soils in a number of ways, and so the processes of tillage, traction and compaction are of vital interest to engineers involved in agriculture. This course investigates these processes by developing a detailed understanding of the response of soils to imposed stresses and their resulting deformations and modes of failure. It uses both classical soil mechanics and recent developments in the application of Critical State soil mechanics to establish a theoretical framework that explains and describes the action of tillage tools, the development of tractive forces, and the process of soil compaction. The course provides a basic understanding of the process of soil disturbance by tillage tools and presents methods for calculating tillage forces and the optimum matching between the tractor and the implement. Methods for measuring and describing soil structure, and efficient operation of soil engaging tools are discussed and linked to plant growth and crop yield.

OBJECTIVES

The course objectives define the student learning outcomes for a course. The assessment item(s) that may be used to assess student achievement of an objective are shown in parenthesis. On completion of this course, students should be able to:

1. assess soil structure, understand its importance for plant growth, and appraise the methods which are being used to sample and quantify it (Assignment 1, Exam);
2. describe and calculate mechanical and strength properties of soil elements (Assignment 1, Assignment 3, Exam);
3. evaluate the tillage process and calculate tillage forces (Assignment 1, Assignment 2, Exam);
4. measure soil forces and compare the influence of different tillage tool designs (Assignment 1, Assignment 2, Exam);
5. describe and interpret the process of soil compaction, calculate its effect on soil properties, and discuss its effects on plant growth (Assignment 1, Assignment 2, Exam);

6. calculate tractive forces, rolling resistance and tractive efficiency of tractor/implement systems (Assignment 1, Exam);
7. understand the basic concepts of critical state soil mechanics, and be able to interpret and predict soil behaviour using these concepts (Assignment 1, Assignment 3, Exam).

TOPICS

| | Description | Weighting (%) |
|----|---|---------------|
| 1. | Soil structures. Soil physical properties. Saturated and unsaturated soils. | 10.00 |
| 2. | Stress theory. Soil failure and mechanical behaviour. Soil strength measurement methods. Derivation of octahedral stresses. | 15.00 |
| 3. | The tillage process and soil failure modes. Calculation of tillage forces. Analysis and design of tillage tools and implements. | 25.00 |
| 4. | Compaction. Description and analysis of the process. Calculation of soil response, implications for root and plant growth. Controlled traffic farming method. | 15.00 |
| 5. | Development of traction by wheels and tracks. Calculation of soil rolling resistance and wheelslip. Optimum matching between the tractor and the implement. | 15.00 |
| 6. | Critical state soil mechanics. Interpretation of soil behaviour and failure modes. Stress paths and planes for agricultural processes. | 20.00 |

TEXT and MATERIALS required to be PURCHASED or ACCESSED

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook Search' facility at <http://bookshop.usq.edu.au> click 'Semester', then enter your 'Course Code' (no spaces).

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.

Atkinson, JH & Bransby, PL 1993, *An introduction to the mechanics of soils and foundations: through critical state soil mechanics*, McGraw Hill, London.

McKyes, E 1985, *Soil cutting and tillage*, Elsevier, Amsterdam.

STUDENT WORKLOAD REQUIREMENTS

| ACTIVITY | HOURS |
|---------------|-------|
| Assessments | 40.00 |
| Examinations | 2.00 |
| Lectures | 26.00 |
| Private Study | 61.00 |
| Tutorials | 26.00 |

ASSESSMENT DETAILS

| Description | Marks out of | Wtg (%) | Due date |
|-------------------------------|--------------|---------|------------------------|
| ASSIGNMENT 1 | 100.00 | 10.00 | 03 Apr 2008 |
| ASSIGNMENT 2 | 100.00 | 10.00 | 11 Apr 2008 |
| ASSIGNMENT 3 | 100.00 | 10.00 | 24 Apr 2008 |
| 2 HOUR RESTRICTED EXAMINATION | 700.00 | 70.00 | END S1 (see note 1) |

NOTES

1. 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 satisfactorily complete an assessment item a student must achieve at least 50% of the marks or a grade of at least C-. Students do not have to satisfactorily complete each assessment item to be awarded a passing grade in this course. Refer to Statement 4 below for the requirements to receive a passing grade in this course.
- 3 Penalties for late submission of required work:
If students submit assignments after the due date without extenuating circumstances then a penalty of 5% of the assigned mark may apply for each working day late up to a maximum of ten working days at which time a mark of zero can be recorded for that assignment.
- 4 Requirements for student to be awarded a passing grade in the course:
To be assured of receiving a passing grade in a course a student must obtain at least 50% of the total weighted marks for the course.
- 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:
Candidates are allowed access only to specific materials during a Restricted Examination. The only materials that candidates may use in the restricted examination for this course are: writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); calculators which cannot hold textual information (students must indicate on their examination paper the make and model of any calculator(s) they use during the examination).
- 7 Examination period when Deferred/Supplementary examinations will be held:
Not applicable.
- 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/corporateservices/calendar/part5.htm> or in 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 produced within five days 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 one of the temporary grades: IM (Incomplete - Make up), IS (Incomplete - Supplementary Examination) or ISM (Incomplete -Supplementary Examination and Make up). A temporary 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).