



The University of Southern Queensland

## Course specification

| <b>Description: Engineering Materials</b> |         |       |         |      |       |           |
|---|---------|-------|---------|------|-------|-----------|
| Subject                                   | Cat-nbr | Class | Term    | Mode | Units | Campus    |
| MEC                                       | 1201    | 54419 | 2, 2006 | ONC  | 1.00  | Toowoomba |

|                                   |        |
|-----------------------------------|--------|
| <b>Academic group:</b>            | FOENS  |
| <b>Academic org:</b>              | FOES02 |
| <b>Student contribution band:</b> | 2      |
| <b>ASCED code:</b>                | 030305 |

### STAFFING

Moderator: Hao Wang

### SYNOPSIS

Materials science and engineering has come into its own as a field of endeavour during the past 25 years. The central theme in this development is the concept that the properties and behaviour of a material are closely related to the internal structure of that material. The properties (which may be regarded as the responses of the material to its immediate environment) are functions of : (i) the kinds of atoms present and the type of bonding among them, and (ii) the geometrical arrangement of large numbers of atoms, microstructure and macrostructure. As a result, in order to modify properties, appropriate changes must be made in the internal structure. Also, if processing or service conditions alter the structure, the characteristics of the material are altered. Over the same period noticeable changes have taken place in the teaching of engineering materials to the engineering student. Previously, elementary courses emphasised the mechanical properties of materials with long dull lists of chemical specifications and descriptions of processing. More recently, elementary courses seek to provide a thorough grasp of the structures encountered in the principal families of materials - metals, ceramics and polymers - and then to show how the properties of important engineering materials depend on these structures. This course seeks to provide a background knowledge of the more commonly used engineering materials. This will be achieved by promoting an understanding of the interrelation of structure and properties in the principal families of materials and the mechanisms by which the structural changes may be accomplished.

### 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. explain the basic atomic structures of metals, ceramics and polymers (Assignment 2, Assignment 3, Exam);
2. outline the influence of both atomic structure and microstructure on the mechanical properties of the materials listed in objective 1 (Assignment 3, Exam);

3. describe the principal forms of mechanical tests and calculate the mechanical properties of engineering materials (Assignment 1, Exam) ;
4. interpret the principal mechanisms by which structural change may be accomplished in engineering materials in order to enhance their mechanical properties (Assignment 2, Assignment 3, Exam);
5. analyse the effects of stress state, temperature and corrosion on the more commonly used engineering materials (Exam);
6. identify the major forms of corrosion commonly found in engineering materials (Exam);
7. examine in depth a selected aspect of engineering materials studies (Exam).

## TOPICS

| Description   | Weighting (%) |
|---|---------------|
| 1. Introduction to Materials Science and Engineering  | 1.00          |
| 2. Atomic Bonding and Structures of Materials         | 9.00          |
| 3. Properties and Testing of Materials                | 15.00         |
| 4. Deformation and Annealing of Metals                | 10.00         |
| 5. Phase Equilibria in Metal Alloy Systems            | 10.00         |
| 6. Non Equilibrium Effects in Metal Alloy Systems     | 10.00         |
| 7. Polymeric Materials                                | 10.00         |
| 8. Ceramic Materials                                  | 10.00         |
| 9. Corrosion of Materials                             | 10.00         |
| 10. Selected studies:                                 | 15.00         |
| 10.1. The Metallurgy of Steels                        |               |
| 10.2. Welding of Metals                               |               |
| 10.3. Electrical and Magnetic Properties of Materials |               |
| 10.4. Cement and Concrete                             |               |
| 10.5. Timber  |               |

## 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).

*MEC1201 Engineering Materials CD-ROM*, USQ Publication,  
(or Study Book 1 and 2)

## 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.

Askeland, DR & Phule, PP 2003, *The Science and Engineering of Materials*, 4th edn, Thompson-Brooks/Cole,

Budinski, KG & Budinski, MK 2004, *Engineering Materials Properties and Selection*, 8th edn, Pearson Education International, Upper Saddle River, NJ.

Callister, WD Jnr 2000, *Materials Science and Engineering, An Introduction*, 5th edn, John Wiley & Sons, New York.

Higgins, RA 1994, *The Properties of Engineering Materials*, 2nd edn, Edward Arnold, London.  
John, VB 2003, *Introduction to Engineering Materials*, 4th edn, Palgrave MacMillan, Basingstoke.

Schaffer, JP et al 1999, *The Science and Design of Engineering Materials*, 2nd edn, McGraw Hill, Boston.

Shackelford, JF 2004, *Introduction to Materials Science for Engineers*, 6th edn, Pearson, Upper Saddle River, NJ.

Smith, WF 1996, *Principles of Materials Science and Engineering*, 3rd edn, McGraw Hill, New York.

## STUDENT WORKLOAD REQUIREMENTS

| ACTIVITY       | HOURS |
|----------------|-------|
| Assessment     | 18.00 |
| Directed Study | 29.00 |
| Examinations   | 2.00  |
| Lectures       | 39.00 |
| Private Study  | 55.00 |
| Tutorials      | 12.00 |

## ASSESSMENT DETAILS

| Description               | Marks out of | Wtg(%) | Due date               |
|---------------------------|--------------|--------|------------------------|
| ASSIGNMENT 1              | 100.00       | 10.00  | 14 Aug 2006            |
| ASSIGNMENT 2              | 100.00       | 10.00  | 04 Sep 2006            |
| ASSIGNMENT 3              | 100.00       | 10.00  | 09 Oct 2006            |
| 2 HOUR CLOSED EXAMINATION | 700.00       | 70.00  | END S2<br>(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 individual assessment item a student must achieve at least 50% of the marks or a grade of at least C-. (Depending upon the requirements in Statement 4 below, students may not have to satisfactorily complete each assessment item to receive a passing grade in this course.)
- 3 Penalties for late submission of required work:  
Because assignment model answers are electronically released promptly after the due date, the penalty for late submission of assignment work will be the loss of all marks awarded for the assignment.
- 4 Requirements for student to be awarded a passing grade in the course:  
To be assured of receiving a passing grade a student must make a reasonable attempt in all the weighted assessment items, achieve at least 40% in the examination and at least 50% of the total weighted marks available 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:  
In a Closed Examination, candidates are allowed to bring only writing and drawing instruments into the examination.
- 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/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 this course students may submit assignments electronically in the format specified in the assignment requirements.
- 4 The Faculty will NOT accept submission of assignments by facsimile.

- 5 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.
- 6 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.
- 7 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.
- 8 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).