

# 1003ENG

## Statics and Materials

### Semester 2 2009

Academic Organisation:	Griffith School of Engineering
Faculty:	Science, Environment, Engineering and Technology
Credit point value:	10
Student Contribution Band:	Band 2
Course level:	Undergraduate
Campus/Location/Learning Mode:	Gold Coast / On Campus / In Person Nathan / On Campus / In Person
Convenor/s:	Dr Hong Guan (Gold Coast) Dr Jim Ness (Nathan)
Enrolment Restrictions:	Nil
This document was last updated:	4 June 2009

#### **BRIEF COURSE DESCRIPTION**

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The purpose of this course is to introduce the basic skills required for engineering designs and the associated communication tools in the form of engineering drawings. The student is also introduced to the fundamental engineering properties of commonly employed materials, and their use in various engineering applications. The course aims to develop the students' ability to communicate technical information through individual drawing assignments and teamwork laboratory reports.

## SECTION A – TEACHING, LEARNING AND ASSESSMENT

### COURSE AIMS

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**1003ENG Statics and Materials:** This course provides a basic knowledge of solid mechanics, elasticity and structural analysis. To expound statics principles and their applications in civil engineering, the methods of static analysis and techniques of engineering computation are discussed. Students are expected not only to acquire a good grasp of the principles but also to develop the computational skills which are vital in obtaining correct engineering solutions. In practice, a wrong solution can lead to an engineering disaster.

In addition, this course will introduce various types of engineering materials. The course is designed for first year students in Engineering, and intended to relate the fundamental properties of both metals and non-metallic materials to the 'real world' of engineering. Knowledge of the physical properties of materials is fundamental to studies of material behaviour. Such studies are a cornerstone of engineering design and practice, whether civil, coastal, electronic, environmental or mechanical. The behaviour of materials under load, including the concepts of stress, strain, elongation and failure are fundamental to engineering design and construction.

This course is designed to enable students to acquire fundamental knowledge in engineering. It forms an integral part of the analysis and design training provided in the four-year Bachelor of Engineering program in Civil Engineering.

### LEARNING OUTCOMES

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Upon successful completion of this course, students should be able to

1. Apply conventional approaches to problems involving static equilibrium in two- and three-dimensions;
2. Distinguish between a concentrated force, a distributed force, the moment of a force and a couple;
3. Distinguish different types of supports and determine support reactions;
4. Determine structural stability and determinacy and understand the principle of superposition and free body diagram concepts;
5. Determine forces in beams, trusses, arches and frames;
6. Determine the centroid of an area, the centre of mass of a body and the second moments of area of simple shapes;
7. Describe the atomic and microstructures of metals, ceramics, polymers and composites, as well as their effects on the mechanical properties of materials;
8. Describe and perform tensile, hardness, and non-destructive testing;
9. Calculate mechanical and elastic properties;
10. Understand the effects of stress, temperature, and degradation in engineering materials;
11. Apply knowledge of the metallurgy of the iron-carbon system to the solution of practical problems.

### CONTENT, ORGANISATION AND TEACHING STRATEGIES

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Statics is the first course in the engineering mechanics sequence. Its primary function is to help the students develop an understanding of the physical laws governing the response of engineering systems to forces. Beyond that, the study of statics enhances the students' reasoning power as applied to the field of engineering, in that the students learn to solve problems logically, using the concept of mathematical models for physical systems. Statics theory and principles are covered in the lectures in a progressive sequence, and are consolidated by demonstrating practical examples in the tutorial classes.

The purpose of the "materials" component of this course is to introduce various types of engineering materials. The course is designed for first year students in Engineering, and intended to relate the fundamental properties of both metals and non-metallic materials to the 'real world' of engineering. This is supported by the laboratory activities which provide students with the opportunity to clarify their own ideas on the content material, to develop teamwork and necessary problem solving skills, and to develop written communication skills. In addition the laboratory sessions will assist students to develop competency in laboratory skills and the interpretation of the results of system measurements. Problem solving exercises elaborating the lecture material will be introduced during the lecture time.

The contact hours in this course consist of:

<u>ACTIVITY</u>	<u>CONTACT HOURS</u>
2 x 2 Hours Lectures (13 Weeks)	52
1 x 1 Hour Tutorial classes (13 Weeks)	13
<u>1 x 2 Hours Laboratory sessions (2 Weeks)</u>	<u>4</u>
Total	<b>69 hours</b>

Attendance at all teaching activities is **COMPULSORY**. The lectures will enable the students to understand the theoretical and practical aspects of the course matter. The tutorial sessions will provide students with the opportunity to discuss and clarify their own ideas on the course material, as well as to ascertain their analytical and computational skills.

## CONTENT SUMMARY

Week	Topic	Lecture/Tutorial Content	Readings
1.	1	Fundamentals of statics (I) (mass, force, units, rigid body, moment, structures and elements, loading)	<sup>(1)</sup> Chapter 1
2.	2	Fundamentals of statics (II) (equilibrium equations, component and resultant forces)	<sup>(1)</sup> Chapter 2
3.	3	Supports and support reactions, determinacy and stability, structures with internal hinge connections	<sup>(1)</sup> Chapter 3
4.	4	Analysis of trusses (I) (determinacy and stability, zero-force members, method of joints)	<sup>(1)</sup> Chapter 4
5.	4	Analysis of trusses (II) (method of joints (cont'd), method of sections)	<sup>(1)</sup> Chapter 4
6.	5	Analysis of forces and moments in space	<sup>(1)</sup> Chapter 5
7.	6	Geometric properties of simple area (centroids and moment of inertia)	<sup>(1)</sup> Chapter 6-7
8.		<b>Mid-Semester Exam</b>	
9.	7	Scope and general properties of materials (crystals and diffusion) Mechanical properties of materials (stress-strain; Young's Modulus; failure)	<sup>(2)</sup> Chapters 1-3; 5 - 6
10.	8	Properties of common materials (metals & alloys; ceramics; polymers; composites materials)	<sup>(2)</sup> Selections from Ch: 8,12,14,15,16
11.	9	Degradation and corrosion of common materials	<sup>(2)</sup> Chapter 17
12.	10	Innovation in materials	To be supplied
13.		<b>Revision</b>	

Note: (1) Readings for Topics 1 to 6 - Loo, Y.C. and Guan, H., *Statics and Structures*.

(2) Readings for Topics 7 to 9 - Callister, W.D. *Materials Science and Engineering: An Introduction 7e*.

## ASSESSMENT

### Summary of Assessment

Item	Assessment Task	Length	Weighting	Relevant Learning Outcomes	Due Day and Time
1.	Seven weekly tutorial assignments on Statics	3 to 5 questions	15%	1-6	One week after each assignment is given
2.	Mid-semester exam (closed book) on Statics	100 mins	15%	1-6	Monday, Week 8
3.	Two laboratory reports (Individual report) on Materials	5-7 pages including graphs & tables	10%	7-11	One week after each lab is completed
4.	Group design assignment on Materials	1000 words	10%	7-11	4PM Friday, Week 13
5.	Final examination (60% on Statics and 40% on Materials)	180 mins	50%	1-11	Examination week

### Assessment Details

Assessment is based on the student's grasp of the underlying principles of the course matters and their ability to apply such principles to practical structural and material problems.

1. Weekly tutorial assignments  
The weekly tutorial exercises assess the ability of the students to apply theory to problems and their understanding of the concepts. Through these tutorials, students' problem solving skills and computational skills will be developed.
2. Mid-semester exam  
The mid-semester exam encourages the students to keep up to date with their work. They also provide continuous feedback to both the students and the teaching team regarding progress and conduct of the course.
3. Two lab reports  
A total of two laboratory reports will be required. The laboratory reports assess the ability of the student to bring together the various materials topics and apply that knowledge, and knowledge gained in the laboratory, to an engineering problem. Through the analysis of the activity in the report, students' problem solving skills and written communication skills will be assessed. Detailed instructions for the laboratory reports will be posted on Learning@Griffith.
4. Group report  
A professional and well referenced design assignment on the use of innovate materials. The ability to understand materials presented during weeks 9-12, as well as spelling, grammar and report structure will be assessed.
5. Final examination  
The final examination is to assess the student's knowledge and understanding of all the topics covered in the course and the ability to apply that understanding to the solution of practical problems. The examination paper is devised also to test the student's computational skills, as well as the ability to apply that knowledge to an engineering design problem.

To be eligible to pass the course, students are required to complete all items of assessment and achieve at least 50 (fifty) percent of total mark. In addition, they must obtain at least 40 (forty) percent in the final examination in order to achieve a grade of "Pass" or above. Further, a satisfactory performance in the laboratory based assignments/reports is necessary to achieve a passing grade in the course and the attendance at laboratory sessions is compulsory.

### Return of Assessment Items and Notification of Availability of Feedback on Assessment

The marked tutorial assignments will be returned to the students two weeks after submission at their respective tutorial classes. The mid-semester exam will be marked within 2 weeks after the exam is conducted and the exam paper will be returned to the students during the lecture time. The assessment results and solutions will be made available at Learning@Griffith.

## **GRADUATE SKILLS**

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The Griffith Graduate Statement states the characteristics that the University seeks to engender in its graduates through its degree programs.

<b>Graduate Skills</b>	<b>Taught</b>	<b>Practised</b>	<b>Assessed</b>
Effective communication (written)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Effective communication (oral)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Effective communication (interpersonal)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Information literacy	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Problem solving	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Critical evaluation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Work autonomously	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Work in teams	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Creativity and innovation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ethical behaviour in social / professional / work environments	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Responsible, effective citizenship	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Professional Skills

Listed below are the discipline specific graduate skills:

- Engineering fundamentals
- Problem identification, formulation and solution
- Professional responsibilities

## **TEACHING TEAM**

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### Course Convenor

<b>Convenor Details</b>	<b>Gold Coast</b>
Campus Convenor	Associate Professor Hong Guan
Email	h.guan@griffith.edu.au
Office Location	G09 Room 1.20
Phone	07 5552 8708
Fax	07 5552 8065
Consultation times	Will be indicated at Learning@Griffith

<b>Convenor Details</b>	<b>Nathan</b>
Campus Convenor	Dr Jim Ness
Email	j.ness@griffith.edu.au
Office Location	N55 Room 2.32
Phone	07 3735 5507
Fax	07 3735 5198
Consultation times	Will be indicated on Learning@Griffith

### Additional teaching team members

<b>Teaching Team</b>	<b>Nathan</b>
Campus Lecturer	Dr Erwin Oh
Email	y.oh@griffith.edu.au
Office Location	G09 Room 1.18
Phone	07 5552 9062
Fax	07 5552 8065
Consultation times	Will be indicated at Learning@Griffith

<b>Teaching Team</b>	<b>Gold Coast</b>
Campus Lecturer	Dr Wayne Hall
Email	TBA
Office Location	TBA
Phone	TBA
Fax	TBA
Consultation times	TBA

### Moderators

Moderator	Nathan
Campus Moderator	Professor Bofu Yu
Email	b.yu@griffith.edu.au
Office Location	N25 Room 1.18B
Phone	07 3735 7486 or 07 5552 9296
Fax	07 3735 5198 or 07 5552 8065

Moderator	Gold Coast
Campus Moderator	Mr Mark Bolton
Email	m.bolton@griffith.edu.au
Office Location	G09 Room 1.21
Phone	07 5552 8377
Fax	07 5552 8065

### **COURSE COMMUNICATIONS**

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The Course Convenor and the tutor are available for consultation at times indicated in the above section. Queries may also be emailed to the Course Convenor or the tutor. The students are required to check their email and Learning@Griffith website on a regular basis.

### **TEXTS AND SUPPORTING MATERIALS**

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#### Specified Texts for Statics Component

1. Loo, Y.C. and Guan, H., *Statics and Structures*, School of Engineering, Griffith University Gold Coast Campus, 3<sup>rd</sup> Edition, 2009.
2. Loo, Y.C., *A Concise Reference Book for Mechanics & Structures*, School of Engineering, Griffith University Gold Coast Campus, 2<sup>nd</sup> Edition, 1998.

#### Specified Texts for Material Component

1. Callister, W.D. *Materials Science and Engineering: An Introduction 7e + Wileyplus Registration Card* (ISBN: 9780470113417). 7<sup>th</sup> Edition, Wiley.

#### Recommended Readings/References

1. Hibbeler, R.C.(2007). *Engineering Mechanics - Statics*, Prentice-Hall, N.J., 11<sup>th</sup> Edition.
2. Meriam, J.L. and Kraige, L.G., *Engineering Mechanics, V.1 Statics*, Wiley, New York, 6<sup>th</sup> Edition, 2008.
3. Beer, F. P.; Johnston, Jr., E. R.; Flori, Jr, R. E. (2008). *Mechanics for Engineers – Statics*, McGraw Hill, 5<sup>th</sup> Edition.
4. Gere, J.M. and Timoshenko, S.P., (1999). *Mechanics of Materials*, Stanley Thornes, Cheltenham, 4<sup>th</sup> SI Edition.
5. Morrow, H.W. and Kokernak, R.P., (2001). *Statics and Strength of Materials*, Prentice-Hall, N.J.
6. Sheppard, S.D. and Tongue, B.H. (2005). *Statics: Analysis and Design of Systems in Equilibrium*, Wiley, N.J.

## SECTION B – ADDITIONAL COURSE INFORMATION

If no additional course information is to be included in this Section, a statement such as "Students should refer to the Learning@Griffith website for further information about this course" should be included.

Faculties/Schools/Convenors may wish to include information in Course Outlines which falls outside the specified subsection headings in Section A. Schools may wish to include additional University policy information in this section, or provide their own information, which accords with, but provides more detail than University policy.

Below are a number of potential subsection headings (sample University level content may be available for some of these):

Assignment Extensions and Penalties	Assignment Submissions and Returns
Copyright	Course Evaluation
Employment Screening	Examinations
Grade Descriptions	Study Program
Student Charter	Risk assessment/health and safety information

The following types of information may previously have been included in the Course Outline but should now be provided via Learning@Griffith and are not considered appropriate for inclusion in the Course Outline:

- Referencing guidelines
- Further reading/additional references
- Forms associated with course administration (attendance forms, assignment cover sheets, etc.)
- Equipment guidelines

## SECTION C – KEY UNIVERSITY INFORMATION

### ACADEMIC MISCONDUCT

Students must conduct their studies at the University honestly, ethically and in accordance with accepted standards of academic conduct. Any form of academic conduct that is contrary to these standards is academic misconduct and is unacceptable.

Some students engage deliberately in academic misconduct, with intent to deceive. This conscious, pre-mediated form of cheating is one of the worst forms of fraudulent academic behaviour, for which the University has zero tolerance and for which penalties, including exclusion from the University, will be applied.

However the University recognises many students commit academic misconduct without intent to deceive. These students may be required to undertake additional educational activities to remediate their behaviour.

Specifically it is academic misconduct for a student to:

- **Cheat in examinations and tests** by communicating, or attempting to communicate, with a fellow individual who is neither an invigilator or member of staff; by copying, or attempting to copy from a fellow candidate; attempting to introduce or consult during the examination, any unauthorised printed or written material, or electronic calculating or information storage device; or mobile phones or other communication device, or impersonates another.
- **Fabricate results** by claiming to have carried out tests, experiments or observations that have not taken place or by presenting results not supported by the evidence with the object of obtaining an unfair advantage.
- **Misrepresent themselves** by presenting an untrue statement or not disclosing where there is a duty to disclose in order to create a false appearance or identity.

- **Plagiarise** by representing the work of another as their own original work, without appropriate acknowledgement of the author or the source. This category of cheating includes the following:
  1. collusion, where a piece of work prepared by a group is represented as if it were the student's own;
  2. acquiring or commissioning a piece of work, which is not his/her own and representing it as if it were, by
    - purchasing a paper from a commercial service, including internet sites, whether pre-written or specially prepared for the student concerned
    - submitting a paper written by another person, either by a fellow student or a person who is not a member of the University;
  3. duplication of the same or almost identical work for more than one assessment item;
  4. copying ideas, concepts, research data, images, sounds or text;
  5. paraphrasing a paper from a source text, whether in manuscript, printed or electronic form, without appropriate acknowledgement;
  6. cutting or pasting statements from multiple sources or piecing together work of others and representing them as original work;
  7. submitting, as one own work, all or part of another student's work, even with the student's knowledge or consent.

A student who willingly assists another student to plagiarise (for example by willingly giving them their own work to copy from) is also breaching academic integrity, and may be subject to disciplinary action.

Visit the following web sites for further details:

[Institutional Framework for Promoting Academic Integrity among Students](#)  
[Academic integrity for students](#)

## **PLAGIARISM DETECTION SOFTWARE**

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The University uses plagiarism detection software. Students should be aware that your Course Convenor may use this software to check submitted assignments. If this is the case your Course Convenor will provide more detailed information about how the detection software will be used for individual assessment items.

## **HEALTH AND SAFETY**

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Griffith University is committed to providing a safe work and study environment, however all students, staff and visitors have an obligation to ensure the safety of themselves and those whose safety may be affected by their actions. Staff in control of learning activities will ensure as far as reasonably practical, that those activities are safe and that all safety obligations are being met. Students are required to comply with all safety instructions and are requested to report safety concerns to the University.

General health and safety information can be obtained from  
[http://www.griffith.edu.au/hrm/health\\_and\\_safety/](http://www.griffith.edu.au/hrm/health_and_safety/)

Information about Laboratory safety can be obtained from  
[http://www.griffith.edu.au/ots/secure/health/content\\_labsafety.html](http://www.griffith.edu.au/ots/secure/health/content_labsafety.html)

## **KEY STUDENT-RELATED POLICIES**

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All University policy documents are accessible to students via the University's Policy Library website at: [www.griffith.edu.au/policylibrary](http://www.griffith.edu.au/policylibrary). Links to key policy documents are included below for easy reference:

[Academic Calendar](#)

[Academic Standing, Progression and Exclusion Policy](#)

[Assessment Policy](#)

[Examinations Timetabling Policy and Procedures](#)

[Guideline on Student E-Mail](#)

[Health and Safety Policy](#)

[Institutional Framework for Promoting Academic Integrity Among Students](#)

[Policy on Student Grievances and Appeals](#)

[Student Administration Policy](#)

[Student Charter](#)

## **UNIVERSITY SUPPORT RESOURCES**

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The University provides many facilities and support services to assist students in their studies. Links to information about University support resources available to students are included below for easy reference:

[Learning Centres](#) - the University provides access to common use computing facilities for educational purposes. For details visit [www.griffith.edu.au/cuse](http://www.griffith.edu.au/cuse)

[Learning@Griffith](#) - there is a dedicated website for this course via the Learning@Griffith student portal.

[Student Services](#) facilitate student access to and success at their academic studies. Student Services includes: Careers and Employment Service; Chaplaincy; Counselling Service; Health Service; Student Equity Services (incorporating the Disabilities Service); and the Welfare Office.

[Learning Services](#) within the Division of Information Services provides learning support in three skill areas: computing skills; library skills; and academic skills. The study skills resources on the website include self-help tasks focusing on critical thinking, exam skills, note taking, preparing presentations, referencing, writing, proof reading, and time management.