USC

Course Outline

Code: ENG102
Title: Engineering Statics

Faculty of: Science, Health, Education and Engineering
School of: Science & Engineering
Teaching Session: Semester 2
Year: 2018
Course Coordinator: Dr Richard White Email: rwhite@usc.edu.au
Course Moderator: A/Prof Christophe Gerber

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

Statics is one of the critical foundations for understanding and progressing in mechanical and civil engineering. It enables you to analyse structural components found in buildings, bridges, machinery and hydraulics. You will learn principles and concepts related to rigid and deformable bodies, and apply these principles to analyse structures under various loads.

1.2 Course topics

- General statics principles and fundamental concepts, e.g. equilibrium of a particles and rigid bodies
- Vectors and force vectors, e.g. 2D & 3D forces, scalar and vector
- Force system resultants, e.g. moment of a force
- Loads and their characteristics: types, tributary areas or widths for distributed loads
- Free-body diagrams (FBDs)
- Structure analysis of trusses, beams, 2D and 3D structures:
  - qualitative analysis;
  - simple beams & pin-jointed structures including trusses;
  - internal actions – axial, shear, moment and torsion;
  - diagrams: axial force (AFD), shear force (SFD) & bending moment diagrams (BMD) of beams, frames, 2D and 3D structures.

2. What level is this course?

100 level Introductory - Discipline knowledge and skills at foundational level, broad application of knowledge and skills in familiar contexts and with support. Normally associated with the first full-time 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:
Demonstrate and apply current knowledge of basic sciences, and *fundamental* engineering statics principles and concepts to structures in engineering design contexts	Task 1: Review Quizzes Task 2: Practical reports Task 3: Final exam	Knowledgeable.
Solve simple engineering statics problems by: • testing and collecting data and dealing with sources of interference • using free body diagrams to represent structures subjected to various loads • interpreting and analysing these diagrams to calculate the resulting internal forces using established conventions to present sequenced solutions	Task 1: Review Quizzes Task 2: Practical reports Task 3: Final exam	Creative and critical thinkers.
Communicate to different audiences in different modes (written, visual and oral)	Task 1: Review Quizzes Task 2: Practical reports Task 3: Final exam	Empowered.
Act professionally by functioning in teams	Task 2: Practical 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

You must be enrolled in Enrolled in Program SC383, SC384, SC410, SC411, SC425, SC430, UU301 or XU301

5.2 Pre-requisites

SCI107 and (MTH102 or MTH103)

5.3 Co-requisites

Nil

5.4 Anti-requisites

CIV1501 (USQ equivalent course)

5.5 Specific assumed prior knowledge and skills (where applicable)

Senior Maths C or equivalent is strongly recommended for ENG102. The following knowledge and skills are required throughout the course and must be learned or maintained as required:

- Construction and interpretation of graphs,
- Basic analytic geometry,
- Basic algebraic manipulations including solution of equations,
- Basic differential and integral calculus,
- Differentiation of simple functions,
- Chain rule and product rule for differentiation,
- Integration of simple functions,
- Matrix notation,
- Vector representation and basic operations,
- Dot product,
- Cross product,
- General concepts of space, matter and time,
- Measurement and SI units,
- Newton's law of gravitation and,
- Forces and Newton's laws of motion.

6. How am I going to be assessed?

6.1 Grading scale

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

6.2 Details of early feedback on progress

Each week throughout semester, students will be able to complete questions before and in tutorials which are similar to the questions they will have in the exam. Solutions to these questions will be discussed in the tutorials are will be available in Blackboard. This gives students constant formative feedback on their understanding of the course material and progress during semester.

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	Review Quizzes	Individual	35% (Quiz 1: 5%, Quizzes 2-4: 10%)	Short answers	Week 3,6,9,12[1)]	In tutorial time
2	Practical reports	Group	15% (5% each)	Three of 450 to 600 words each excluding diagrams & appendices	Friday, 4:00pm weeks 3, 6, 9[1)]	Hard copy to drop box
3	Final examination	Individual	50%	2hours	Centrally scheduled Exam Period	
			100%			

[1)] Possible changes subject to Public Holidays.

Assessment Task 1: Review Quizzes 1-4

Goal:	This task has been developed to provide you with clear and thorough examples of the types of problems engineers need to address in statics. You will apply fundamental knowledge of statics principles and concepts to solve problems about structures subjected to loads.
Product:	Sequenced solutions to problems with diagrams
Format:	Short answers such as: • interpreting symbols in free body diagrams • labelling diagrams following conventions • solving 2D & 3D force systems involving calculations, sketching, etc. • analysing structures (beams, frames, 2D and 3D structures) under different loads, requiring drawing a free body diagram to represent the structure, using a sequence of equations to calculate the unknown forces and/or drawing diagrams. Programmable calculators NOT permitted but scientific ones are. The use of mobile phones and tablets is not permitted. The review quizzes will be open book, with both notes and textbook allowed.
Criteria:	1. Demonstrate and apply current knowledge of basic sciences, and fundamental engineering statics principles and concepts to structures in engineering design contexts 2. Solve simple engineering statics problems by: • using free body diagrams to represent structures subjected to various loads • interpreting and analysing these diagrams to calculate the resulting internal forces using established conventions to present sequenced solutions 3. Communicate to specialist audiences in written and visual modes to present solutions: • terminology, nomenclature and units • adhere to established conventions for diagrams

Assessment Task 2: Practical reports

Goal:	These practical reports will enable you to better understand and master key statics theory and principles that involve rigging, lifting, and fixed structures. Ultimately you will be able to test and collect data to validate theoretical calculations about how structures react to loads.
Product:	Three reports of practical activities
Format:	In groups of 3-5 (depending on the class size), you carry out tests to collect data about how real structures react to different loads, taking account of any sources of interference. In your team you collaborate to write three engineering reports (one on each Practical) as per conventions (see BlackBoard). Each report is of 450 to 600 words or equivalent (excluding diagrams, calculations and Appendices) and calculations with correct units throughout (scanned copies of pre-practical calculations are acceptable), explain sources of interference. You also include where relevant captioned diagrams, tables of data, graphs, and photographs. The names of all team members are to be on the cover page of each report with their signatures and student numbers.
Criteria:	1. Demonstrate and apply current knowledge of basic sciences, and fundamental engineering statics principles and concepts to structures in engineering design contexts 2. Solve simple engineering statics problems by: • testing and collecting data and dealing with sources of interference 3. Communicate in the form of written practical reports • adhere to prescribed report structure and word count • English expression and conventions • terminology, nomenclature and units • adhere to established conventions for presenting diagrams and solutions 4. Act professionally by functioning in teams when carrying out and writing up practicals You are awarded an individual grade for each report. Marks are recorded and made available to you through Gradebook.

Assessment Task 3: Final Exam

Goal:	You will demonstrate and apply fundamental knowledge of statics principles and concepts to solve simple problems about structures subjected to loads
Product:	Sequenced solutions to problems with diagrams
Format:	The problems in this exam involve more complex theory and structures, and test all the Course topics. Short answers such as: • interpreting symbols in free body diagrams • labelling diagrams following conventions • solving 2D and 3D force systems, trusses and pin-jointed frame— involves calculations • interpreting diagrams of simple structure under different loads, requiring drawing a free body diagram to represent the structure, and using a sequence of equations to calculate the unknown forces • calculate and draw internal forces diagram. Programmable calculators NOT permitted but scientific ones are. The use of mobile phones and tablets is not permitted. The examination will be open book, with both notes and text book allowed.
Criteria:	1. Demonstrate and apply current knowledge of basic sciences, and fundamental engineering statics principles and concepts to structures in engineering design contexts 2. Solve simple engineering statics problems by: • using free body diagrams to represent structures subjected to various loads • interpreting and analysing these diagrams to calculate the resulting internal forces using established conventions to present sequenced solutions 3. Communicate to specialist audiences in written and visual modes to present solutions: • terminology, nomenclature and units • adhere to established conventions for diagrams.

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 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	2 hour lecture and 2 hour tutorial per week except week 1 where there are 2 x 2 hour lectures and no tutorial. Practicals are held separately – 3 x 2 hours

7.2 Course content

Week # / Module #	**What key concepts/content will I learn?**
1	Introduction: – Where statics fits into your degree and future work. – Course general information- objectives, teaching and learning philosophy, expectations. Newton's laws of motion SI units.

	Equilibrium of a particle in 2D; free body diagrams (FBDs); 2D problems including coplanar force systems; equilibrium of 2D force systems. **Need to know**: Fundamental principles and quantities of mechanics: – vector addition and subtraction – forces and their characteristics – resultants and components of a force; resultant of multiple forces, rectangular components including resultants using rectangular components – dot product – cross product
2	External forces on 2D rigid bodies; principle of transmissibility; moment of a force; Varignon's theorem; couples and 'move the force' trick; equivalent loads; free body diagrams (FBDs).
3	2D free body diagrams (FBDs) and equilibrium of 2D rigid bodies and valid sets of equilibrium equations, i.e. use of 3 fundamental equations of static equilibrium; statically determinate systems.
4	Statically determinate systems: pin properties, pin-jointed trusses, compound beams and pin-jointed frames (introduction); Analysis of pin-jointed trusses: qualitative analysis (zero force and equal force members).
5	Analysis of pin-jointed trusses: qualitative analysis (zero force and equal force members, and counters); **method of joints; and method of sections.**
6	Analysis of pin-jointed trusses: Consolidation of qualitative analysis, method of joints and method of sections.
7	Qualitative analysis of 2D structures: Introduction and application. Internal actions: Introduction, calculating internal actions using equilibrium and drawing internal action diagrams; *effects of crossing a load or moment; equations of internal actions from FBDs*; typical loads.
8	Qualitative analysis of 2D structures: Consolidation. Derivation of $dV/dx=\omega$ and $dM/dx=V$; *equations of internal actions from FBDs;* equations of shear force and bending moment using these; drawing shear force and bending moment diagrams using $dV/dx=\omega$ and $dM/dx=V$; qualitative analysis.
9	Statically determinate systems: Qualitative analysis of compound beams and pin-jointed frames, calculating internal actions and drawing internal action diagrams of these structures.
10	Statically determinate systems: Consolidation of structural analysis of 2D structures.
11	Statically determinate systems: FBDs and equilibrium of 3D rigid bodies and valid sets of equilibrium equations; Calculating internal actions and drawing internal action diagrams of 3D structures.
12	Statically determinate systems: Equilibrium of 3D (simple) structures; equilibrium of particles in 3D and 3D force systems; *rectangular components and equilibrium; scalar approach*.
13	Revision and summary.

Please note course content is subject to variation.

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 you need to have regular access to the resource(s) listed below as they are required:

Author	Year	Title	Publisher
Hibbeler, R. & Yap, K.	2012	Mechanics for Engineers: Statics (13th SI edition)	Singapore: Pearson Education South East Asia. Pty, Ltd

8.2 Specific requirements

You must wear closed-in shoes in the laboratory.

9. Risk management

Health and safety risks for this course have been assessed as low.

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