



## Course Outline

**Code: ENG228**

**Title: Mechanical Design 2**

<b>School:</b>	Science & Engineering
<b>Teaching Session:</b>	Semester 1
<b>Year:</b>	2019
<b>Course Coordinator:</b>	Selvan Pather Email: <a href="mailto:spather@usc.edu.au">spather@usc.edu.au</a>
<b>Course Moderator:</b>	Rezwanul Haque Email: <a href="mailto:rhaque@usc.edu.au">rhaque@usc.edu.au</a>

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**

We live in a world of change which is driven by innovation and the desire for more efficient and sustainable machines and devices. This course provides you with the knowledge and skills to understand the design need, recognise the theory required and to synthesise an integrated solution. Machines comprise of a number of components working together to create a useful and efficient device. The course introduces you to the fundamental theory, applications and interaction of a number of components, which will work in an integrated manner to achieve the design requirements of the machine.

#### **1.2 Course topics**

1. Stress Concentration
2. Fracture
3. Fatigue
4. Buckling
5. Threaded Fasteners and Power Screws
6. Riveted, Welded and Bonded Joints
7. Springs
8. Bearings
9. Belt and Chain Drives
10. Spur Gears
11. Shafts and Shaft Fittings

### **2. What level is this course?**

200 level Developing - Applying broad and/or deep knowledge and skills to new contexts. May require pre-requisites and introductory level knowledge/skills. Normally undertaken in the 2nd or 3rd 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	Assessment Tasks	Graduate Qualities or Professional Standards mapping
On successful completion of this course you should be able to:	You will be assessed on the learning outcome in task/s:	Completing these tasks successfully will contribute to you becoming:
Demonstrate an understanding of the appropriate analytical principles to describe, design and predict the behaviour of standard machine components.	Task 1 – Assignment Solutions Task 3 – Final Examination	Knowledgeable. Empowered.
Apply correct theoretical models to design appropriate machine components.	Task 1 – Assignment Solutions	Creative and critical thinkers. Knowledgeable.
Evaluate the design of machines; with respect to form and function parameters, material selection, and safety, and present these in an appropriate display and engineering report.	Task 2 – Workshop Portfolio (Design Projects)	Creative and critical thinkers. Engaged.
Design, build and test a simple mechanism which incorporates at least four components addressed in this course.	Task 2 – Workshop Portfolio (Design Projects)	Creative and critical thinkers. Empowered.

#### 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

Must be enrolled in Program SC410, SC411. AB101, UU301 or XU301

##### 5.2 Pre-requisites

(ENG221 or MEC2402) and (ENG227 or MEC2304)

##### 5.3 Co-requisites

Nil

##### 5.4 Anti-requisites

MEC2301 Design of Machine Elements (USQ)

##### 5.5 Specific assumed prior knowledge and skills (where applicable)

Nil

#### 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 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	Assignment 1; Assignment 2; Assignment 3	Individual	Total 35% (8% 12% 15%)	Each assignment would, on average, require 3 hours of independent effort.	Monday Week 4; Monday Week 8; Monday Week 12	Blackboard
2	Workshop Portfolio: Project 1 – Material Selection and testing; Project 2 – Design Build and Test.	Group	Total 15% (5% 10%)	Design output and associated report --- max 10 pages + appropriate diagrams/drawings	Monday Week 13	In Class
3	Final Examinations	Individual	50%	2 hours	Centrally Scheduled Exam Period	Exam Collection
			100%			

### Assessment Task 1: Assignments (35% of final grade)

<b>Goal:</b>	You will develop skills and understanding of analytical design principles, material selection criteria and performance behaviour of standard components, which will allow you to design appropriate fit-for-purpose machine parts.
<b>Product:</b>	Solutions to component design questions.
<b>Format:</b>	<p>Questions will be set for each of the assignments, from the material covered in the lectures up to and including the week prior to the submission. You are required to use the theory introduced in the lectures to respond to the assignment questions.</p> <p>The assignments will be provided to you on Blackboard. You are required to complete the assignments and submit by the Monday of each submission week. The assignments have varying weighting: Assignment 1 = 8%; Assignment 2 = 12%; Assignment 3 = 15%.</p> <p>Assignment submissions can either be hand-written or word-processed, showing all working and calculations (where relevant).</p> <p>You must submit your assignments online (Instructions will be provided on Blackboard).</p>
<b>Criteria:</b>	<p>Assessment Criteria:</p> <ul style="list-style-type: none"> <li>• Correct responses to the questions;</li> <li>• Use of correct terminology, diagrams and methodology;</li> <li>• Demonstrated understanding through use of correct formulae; and</li> <li>• Inclusion of all workings showing a logical sequence to the problem solution.</li> </ul>
<b>Generic skill assessed</b>	<b>Skill assessment level</b>
Applying technologies	Developing
Problem solving	Developing
<b>Engineers Australia competencies assessed in this task:</b>	
<p>1.3 I-depth understanding of specialist bodies of knowledge within the engineering discipline</p> <p>2.3 Application of systematic engineering synthesis and design process</p> <p>3.2 Effective oral and written communication in professional and lay domains</p>	

**Assessment Task 2: Workshop Portfolio (15% of final grade)**

<b>Goal:</b>	These practical tasks will enable you enhance your understanding of machine component design by applying keys aspects of design criteria, materials selection, fracture mechanics. The second activity will allow you to demonstrate creativity, innovation and design methodology in designing, Building and testing machine components and systems.
<b>Product:</b>	A portfolio which includes the analysis of material selection and fracture mechanics and documents details of the design, build and test of two mechanical devices that meet the design brief (detailed information about each project will be distributed in class and on Blackboard).
<b>Format:</b>	The projects are completed by groups of 3 students. The portfolio and the built mechanical devices are to be submitted by the group. The portfolio should NOT be longer than 10 pages
<b>Criteria:</b>	Assessment Criteria: <ul style="list-style-type: none"> <li>• Analysis of materials selection and materials testing exercises.</li> <li>• Structured approach to design, test and build (Design methodology)</li> <li>• Appropriate use of materials</li> <li>• Performance of the device, measured against performance criteria stated in the design brief</li> <li>• Completeness of all components of the report within the specified page limit; and</li> <li>• Depth of discussion and reflection on the project (Design Review).</li> </ul>
<b>Generic skill assessed</b>	
<b>Skill assessment level</b>	
Problem solving	Developing
Collaboration	Developing
Communication	Developing
<b>Engineers Australia competencies assessed in this task:</b>	
2.2 Fluent application of engineering techniques, tools and resources	
3.3 Creative, innovative and pro-active demeanour	
3.6 Effective team membership and team leadership	

**Assessment Task 3: Final Examination (2 hrs – 50% of final grade)**

<b>Goal:</b>	You will solve problems to demonstrate and apply your knowledge of the design, behaviour and performance of machine components.
<b>Product:</b>	Solutions to final examination questions.
<b>Format:</b>	The final open-book exam will assess the content of the entire course. The duration of the final exam will be 2 hours (during centrally scheduled exam period, open book). You will be required to provide responses to a number of typical problems similar to those given in the tutorial and assignment questions throughout the semester. Your exam solutions will be used to evaluate your understanding of the total course material.
<b>Criteria:</b>	Assessment Criteria: <ul style="list-style-type: none"> <li>• Correct answers to the problems</li> <li>• Use of correct terminology, diagrams and methodology</li> <li>• Use of appropriate design standards</li> </ul>
<b>Generic skill assessed</b>	
<b>Skill assessment level</b>	
Problem solving	Developing
Applying technologies	Developing
<b>Engineers Australia competencies assessed in this task:</b>	
2.2 Fluent application of engineering techniques, tools and resources	
2.3 Application of systematic engineering synthesis and design processes	
3.2 Effective oral and written communication in professional and lay domains	

## 7. What are the course activities?

### 7.1 Directed study hours

13 x 2 hr Lectures  
13 x 2 hr Tutorials  
13 x 1 hr Workshop sessions

### 7.2 Teaching semester/session(s) offered

Sippy Downs: Semester 1

### 7.3 Course content

Teaching Week / Module	What key concepts/content will I learn?	What activities will I engage in to learn the concepts/content?	
		Directed Study Activities	Independent Study Activities
Week 1	Introduction Revision of Stress Analysis and Engineering Materials Design Fundamentals	Lectures and Tutorials Workshop Project 1 A – Material Selection	Revise design theory from (i) Mechanics of Materials ; (ii) Mechanical Design 1
Week 2	Stress Concentration Factors Introduction to Fracture Mechanics	Lectures and Tutorials Workshop Project 1 A – Material Selection	Tutorial exercise and revision examples
Week 3	Buckling	Lectures and Tutorials Workshop Project 1 B – Material Testing	Tutorial exercise and revision examples
Week 4	Fatigue	Lectures and Tutorials Workshop Project 1 B – Material Testing	Tutorial exercise and revision examples
Week 5	Fatigue	Lectures and Tutorials Workshop Project 1B – Material Testing	Tutorial exercise and revision examples
Week 6	Threaded Fasteners	Lectures and Tutorials Workshop Project 2A – Design Project	Tutorial exercise and revision examples
Week 7	Riveted, bonded and welded joints	Lectures and Tutorials Workshop Project 2A – Design Project	Tutorial exercise and revision examples
Week 8	Springs	Lectures and Tutorials Workshop Project 2B – Design Project	Tutorial exercise and revision examples
Week 9	Bearings	Lectures and Tutorials Workshop Project 2B – Design Project	Tutorial exercise and revision examples
Week 10	Belt and Chain Drives	Lectures and Tutorials Workshop Project 2B – Design Project	Tutorial exercise and revision examples
Week 11	Spur Gears	Lectures and Tutorials Workshop Project 2B – Design Project	Tutorial exercise and revision examples
Week 12	Shafts and Shaft Fittings	Lectures and Tutorials Workshop Project 2B – Design Project	Tutorial exercise and revision examples

Week 13	Revision	Lectures and Tutorials Workshop Portfolio	Tutorial exercise and revision examples
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Please note that the course activities may be 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
Juvinal RC , Marshak KM	2012	Machine Component Design, 5 <sup>th</sup> Ed International Student Version	Wiley
Standards Association of Australia	1999	Design standards for mechanical engineering students: handbook (SAA HB 6-1999), 4th edn	Standards Australia

### 8.2 Specific requirements

Fully enclosed shoes (preferably safety shoes/boots) must be worn in the engineering laboratory. If you do not have the correct shoes you will not be allowed to do the workshop practical. You must also undertake the laboratory induction before you can undertake any practical. It is advisable to use a dust-coat (or overall) when in the laboratory.

## 9. Risk management

There is minimal health and safety risk in this course. There will be an induction into the safe use of all hand tools which will be used in these workshops.

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](mailto: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 SouthBank** - 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

Tel: +61 7 5430 2890

Email: [studentcentral@usc.edu.au](mailto:studentcentral@usc.edu.au)