



## COURSE OUTLINE

# ENG228 Mechanical Design 2

**Course Coordinator:** Selvan Pather (spather@usc.edu.au) **School:** School of Science, Technology and Engineering

2021 | Semester 1

USC Sunshine Coast

**ON CAMPUS**

Most of your course is on campus but you may be able to do some components of this course online.

*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 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 machine components, which will work in an integrated manner to achieve the design requirements of the machine.

### 1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
<b>ON CAMPUS</b>			
<b>Lecture</b>	2hrs	Week 1	13 times
<b>Tutorial/Workshop</b> – Tutorial	2hrs	Week 1	13 times
<b>Laboratory</b> – Workshop	1hr	Week 1	13 times

### 1.3. Course Topics

1. Overview of Design Consideration – Loads, stresses and Material Selection
2. Bending of Curved Beams
3. Stress Concentration
4. Fatigue
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. Buckling
12. Shafts and Shaft Fittings

## 2. What level is this course?

200 Level (Developing)

Building on and expanding the scope of introductory knowledge and skills, developing breadth or depth and applying knowledge and skills in a new context. May require pre-requisites where discipline specific introductory knowledge or skills is necessary. Normally, undertaken in the second or third full-time year of an undergraduate programs.

### 3. What is the unit value of this course?

12 units

### 4. How does this course contribute to my learning?

COURSE LEARNING OUTCOMES	GRADUATE QUALITIES
On successful completion of this course, you should be able to...	Completing these tasks successfully will contribute to you becoming...
1 Demonstrate an understanding of the appropriate analytical principles to describe, design and predict the behaviour of standard machine components.	Knowledgeable Empowered
2 Apply correct theoretical models to design appropriate machine components.	Knowledgeable Creative and critical thinker
3 Design, build and test a multi-motion machine as per the Weir-Warman design brief.	Creative and critical thinker 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. Pre-requisites

(ENG221 or MEC221 or MEC2402) and (ENG227 or MEC227 or MEC2304) and enrolled in Program SC410, SC411

#### 5.2. Co-requisites

Not applicable

#### 5.3. Anti-requisites

MEC2301

#### 5.4. Specific assumed prior knowledge and skills (where applicable)

Not applicable

### 6. How am I going to be assessed?

#### 6.1. Grading Scale

Standard Grading (GRD)

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

#### 6.2. Details of early feedback on progress

The engagement in weekly formative tutorial exercises will demonstrate the level of proficiency and understanding of the course material.

### 6.3. Assessment tasks

DELIVERY MODE	TASK NO.	ASSESSMENT PRODUCT	INDIVIDUAL OR GROUP	WEIGHTING %	WHAT IS THE DURATION / LENGTH?	WHEN SHOULD I SUBMIT?	WHERE SHOULD I SUBMIT IT?
All	1	Written Piece	Individual	35%	Each assignment would, on average, require 3 hours of independent effort.	Refer to Format	Online Assignment Submission
All	2	Portfolio	Group	15%	Design output and associated report - -- max 10 pages + appropriate diagrams/drawings	Week 13	To be Negotiated
All	3	Examination - Centrally Scheduled	Individual	50%	2 hours	Exam Period	Exam Venue

#### All - 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>	Written Piece													
<b>FORMAT:</b>	Submit: Monday Week 4; Monday Week 8; Monday Week 12. 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. 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%. Assignment submissions can either be hand-written or word-processed, showing all working and calculations (where relevant). You must submit your assignments online (Instructions will be provided on Blackboard).													
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#### All - Assessment Task 2: Workshop Portfolio: Project 1 - Material Selection and testing; Project 2 - Design Build and Test.

<b>GOAL:</b>	This activity will allow you to demonstrate creativity, innovation and design methodology in designing, building and testing machine components and systems
<b>PRODUCT:</b>	Portfolio
<b>FORMAT:</b>	The project is completed by groups of 3 students. The portfolio and the built mechanical device are to be submitted by the group. The portfolio should NOT be longer than 10 pages

CRITERIA:	No.	Learning Outcome assessed
	1	Analysis of materials selection and materials testing exercises.
	2	Structured approach to design, test and build (Design methodology)
	3	Appropriate use of materials
	4	Performance of the device, measured against performance criteria stated in the design brief
	5	Completeness of all components of the report within the specified page limit
	6	Depth of discussion and reflection on the project (Design Review).

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

<b>GOAL:</b>					
<b>PRODUCT:</b>	Examination - Centrally Scheduled				
<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.				
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## 7. Directed study hours

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.

## 7.1. Schedule

PERIOD AND TOPIC	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

## 8. What resources do I need to undertake this course?

Please note: 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) or course reader

Please note that you need to have regular access to the resource(s) listed below. Resources may be required or recommended.

REQUIRED?	AUTHOR	YEAR	TITLE	PUBLISHER
Required	Juvinall RC , Marshek KM	2012	Machine Component Design,	Wiley
Recommended	Standards Association of Australia	1999	Design standards for mechanical engineering students: handbook (SAA HB 6-1999)	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. How are risks managed in this course?

Risk assessments have been performed for all laboratory classes and a low level of health and safety risk exists. Some risk concerns may include equipment, instruments, and tools; as well as manual handling items within the laboratory. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the [online induction training 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:

The final mark is in the percentage range 47% to 49.4%

The course is graded using the Standard Grading scale

You have not failed an assessment task in the course due to academic misconduct

### 10.3. Assessment: Submission penalties

Late submission of assessment tasks may 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 to negotiate an outcome.

### 10.4. Study help

For help with course-specific advice, for example what information to include in your assessment, you should first contact your tutor, then your course coordinator, if needed.

If you require additional assistance, the Learning Advisers are trained professionals who are ready to help you develop a wide range of academic skills. Visit the [Learning Advisers](#) web page for more information, or contact Student Central for further assistance: +61 7 5430 2890 or [studentcentral@usc.edu.au](mailto:studentcentral@usc.edu.au).

## 10.5. Wellbeing Services

Student Wellbeing provide free and confidential counselling on a wide range of personal, academic, social and psychological matters, to foster positive mental health and wellbeing for your academic success.

To book a confidential appointment go to [Student Hub](#), email [studentwellbeing@usc.edu.au](mailto:studentwellbeing@usc.edu.au) or call 07 5430 1226.

## 10.6. AccessAbility Services

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, learning disorder mental health issue, , injury or illness, or you are a primary carer for someone with a disability or who is considered frail and aged, [AccessAbility Services](#) can provide access to appropriate reasonable adjustments and practical advice about the support and facilities available to you throughout the University.

To book a confidential appointment go to [Student Hub](#), email [AccessAbility@usc.edu.au](mailto:AccessAbility@usc.edu.au) or call 07 5430 2890.

## 10.7. 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>

## 10.8. General Enquiries

### In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **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
- **USC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

**Tel:** +61 7 5430 2890

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