USC

Course Outline

Code: ENG405
Title: Dynamics 2

School of: Science & Engineering
Teaching Session: Semester 2
Year: 2019
Course Coordinator: Dr Tongfei Tian Email: ttian@usc.edu.au
Course Moderator: Dr Carolyn Jacobs Email: cjacobs1@usc.edu.au

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

Mechanical engineering systems have moving parts that impact on each other. The interconnection of components and the existence of fluctuating forces cause vibrations that must be damped out. The relationships between motions, forces, moments and energy are all expressible as mathematical equations that can be developed from first principles. In this course, you will learn how to employ differential equations, vectors, operators, matrices and tensors to represent the forces and motions in mechanical systems. These skills are built up as understandable solutions to practical engineering problems.

1.2 Course topics

- Mathematical tools for analysis of dynamic systems
- Rigid body Kinematics
- Rigid body kinetics
- 3D Kinematics of rigid body
- 3D kinetics of rigid body
- Theory of vibration
- Free, Forced and Damped vibration
- Harmonic
- Non-harmonic
- Vibration control
- Feedback loop control

2. What level is this course?

400 level Graduate - Independent application of graduate knowledge and skills. Meets AQF and professional requirements. May require pre-requisites and developing level knowledge/skills. Normally taken in the 4th 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:
Analyse the kinematics and kinetics of 3D rigid bodies in mechanical engineering systems	1	Knowledgeable. Creative and critical thinkers.
Interpret and apply equations to model the dynamic behaviours of engineering systems	1,2	Engaged. Empowered.
Construct and employ mathematical models of engineering systems to determine their dynamic characteristics	1,2	Knowledgeable. Engaged.
Identify, explain and apply the principles of vibration theory, vibration measurements and control to mechanical systems	2,3	Knowledgeable. Creative and critical thinkers.
Select and use software including commercially available packages such as MATLab to analyse the dynamics of engineering systems and recommend solutions	1,2,3	Engaged. 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

This course is only available to students in SC411 program.

5.2 Pre-requisites

(MTH202 or MTH104) and (ENG205 or MEC2401)

5.3 Co-requisites

Nil

5.4 Anti-requisites

USQ MEC3403

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 Details of early feedback on progress

The online activities assessment item will provide students with regular feedback beginning from the first week of semester. This will primarily be in the form of short online quizzes run through the Blackboard system..

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	Tutorial exercises	Individual	20%	1000 words	Weeks 2, 4, 6, 8	In class
2	Mid Semester Exam	Individual	30%	2hrs	Week 9	Blackboard
3	Final Exam	Individual	50%	2hrs	Centrally Scheduled Exam Period	Exam venue
			100%			

Assessment Task 1: Tutorial Exercises

Goal:	The goal is to explain of the concepts of dynamics and apply this knowledge to solve problems in dynamic systems.
Product:	Tutorial Exercises
Format:	This is an ongoing task to ensure that you are building on the analytical skills required in solving Dynamics problems. Solutions prepared to problems.
Criteria:	You will be assessed on: • Explanation of analytical problems in moving bodies • Application of concepts in dynamics to real engineering problems • Ability to represent motion and forces by mathematical equations • Application of software to solving problems in dynamic systems
Engineers Australia competencies assessed in this task	
1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	
1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	
3.5. Orderly management of self, and professional conduct	

Assessment Task 2: Mid Semester Exam

Goal:	You will demonstrate and apply knowledge methods of representing and analysing relationships between forces, displacements, energy and momentum in mechanical systems
Product:	Mid semester Exam
Format:	A number of real engineering problems involving movements of parts and applications of forces will be given. You will respond by analysing the problem and providing a solution by applying mathematical methods.
Criteria:	You will be assessed on: • Application of equations to model the dynamic behaviours of engineering systems • Ability to construct and employ mathematical models to dynamic systems • Identify, explain and apply vibration theory to real mechanical systems.
Engineers Australia competencies assessed in this task	
1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	
1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline	
2.1. Application of established engineering methods to complex engineering problem solving.	
2.2. Fluent application of engineering techniques, tools and resources.	

Assessment Task 3: Final Exam

Goal:	This exam will cover the entire course and will allow you to demonstrate you have developed skills in analysing dynamics in engineering systems and be able to recommend solutions for problems encountered in dynamics
Product:	Written Exam
Format:	You will respond to a set of questions representing problems from mechanical systems
Criteria:	You will be assessed on: • Accuracy of the explanations of constructing mathematical models of dynamics concepts • Accuracy of the application of analytical approach in solving vibrations • Application of the concepts of control methods in vibration
Engineers Australia competencies assessed in this task	
1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	
1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	
2.1. Application of established engineering methods to complex engineering problem solving	
2.2. Fluent application of engineering techniques, tools and resources.	

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 it 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	Lectures - 2 hours/week from week 1 Tutorials - 2 hours/week from week 2

7.2 Course content

Week # / Module #	**What key concepts/content will I learn?**
1	Revising Newton's laws
2	Kinematics of Rigid Bodies
3	3D Kinematics
4	Mathematical models
5	Discretization of systems
6	Adapting problems for computer solution
7	Theory of vibration I
8	Theory of Vibration II
9	Theory of vibrations III
10	Vibration and control
11	Vibration and control
12	Vibration measurements
13	Review

Please note that course contents are 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, RC	2016	Engineering mechanics: statics and dynamics	14th edn, Pearson, New Jersey

Required and recommended readings

Rao, SS	2017	Mechanical vibrations	Prentice Hall, Upper Saddle River, NJ

8.2 Specific requirements

N/A

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