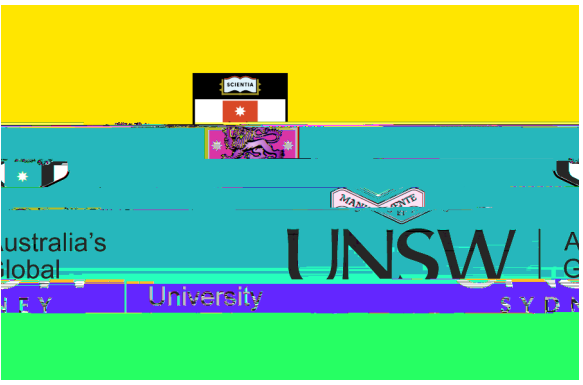

Mechanical and Manufacturing Engineering

Course Outline

Term 2 2019

MTRN4230

Robotics

Contents

UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work.

You should aim to spend about 12 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Contact hours

	Day	**Time**	**Location**
Lectures	Monday	12noon - 2pm	Colombo Theatre C (K-B16-

applications; the main categories of robot frames of reference; and the essentials of robot kinematics, dynamics, control and path planning. Major projects require students to apply the theory to integrate a robot manipulator, simulation software, vision system and safety system to demonstrate the operation of a robot cell. Problem solving, project management and group work skills are developed throughout the semester as a foundation for graduate positions.

This is a final year course in the Mechatronics stream and builds on much content from previous courses including dynamics, robot design, control systems and computing. It seeks to expose students to the whole field of robotics and prepare them for graduate roles in the mechatronics industry.

The following are the course objectives:

- Understand the main categories of robot frames of reference.
- Understand the essentials of robotic kinematics and dynamics and calculate predictive paths.
- Be able to learn and then use the programming environment of a robot to perform a particular task.
- Be able to learn and then use high-level robot simulation software integrating the results with a real robot.
- Enable you to work in groups to improve problem-solving skills using computation.

Student learning outcomes

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

Learning Outcome		**EA Stage 1 Competencies**
1.	Learn a robot environment and put it to use effectively and efficiently on a given task	2.1, 2.2, 2.4, 3.4, 3.6
2.	Understand robot mechanics and use this knowledge to calculate robot performance	1.3, 1.4, 2.1, 2.2, 3.2, 3.4, 3.5
3.	Implement good safety practices in the use of robots	1.6, 2.2, 3.5
4.	Apply and evaluate image processing techniques in robotics	1.1, 1.2, 1.3, 2.1, 2.2
5.	Apply engineering management and technical tools fluently and systematically	2.2, 2.4, 3.1, 3.2, 3.4, 3.5, 3.6

4. Teaching strategies

The following strategies will be used to teach the subject matter of this course:

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Week	Lecture Topic	Tutorial Content	Lab content
7	Kinematics: Robot trajectory design, path planning 1	Asst1 working	PSE4 assessment + group project time
8	Path planning 2 and joint dynamics and control	Asst1 working	Group project time
9	Dynamics: Rigid-body equations of motion	Asst1 assessment	Group project time
10			

6. Assessment

Assessment overview

Assessment	Group Project? (# Students per group)	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Safety	No	N/A	5%	3	Demonstrate ability to use robot cell	Moodle quiz, 5pm Friday week 2, In-person safety test, end of week 2 lab	N/A	Immediately
Problem Solving Exercises (PSEs)	No	N/A	25%	1, 2, 4	Demonstrate solution to demonstrator	PSE1: end of your week 3 lab, PSE2: End of your week 4 tutorial, PSE3: End of your week 5 lab, PSE4: End of your week 7 lab	N/A	1 week after submission -0 0 9 518.d

Assignments

Presentation

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

Late submissions are **not permitted** in this course. An extension may only be granted by means of special consideration (see below).

Marking

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Examinations

There is no final examination for this course, but the final assignment is due during the exam period as specified above.

Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

Please note that UNSW now has a Fit to Sit / Submit rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see t do s.[s)-17do s.728 -1.315 Td[)-2 (s)8.9 (m)-6 (ent)4.2 (TJ0.005oi.T

The full book is also available online for download through the UNSW library:
https://primoa.library.unsw.edu.au/primo-explore/fulldisplay?docid=UNSW_ALMA51228764990001731&context=L&vid=UNSWS&lang=en_US
The first edition (2011) of this textbook is also appropriate.

Lecture slides and supporting course notes will be available on Moodle.

Additional References

Spong, M., Hutchinson, S. and Vidyasagar, M., Robot Modeling and Control, 2006, John Wiley & Sons.
This text is a classic in robotics and contains well-presented derivations of the theoretical concepts covered in the course.

Spong, M. and Vidyasagar, M., Robot Dynamics and Control, 1989, John Wiley & Sons.

Craig, J. J., Introduction to Robotics (3rd Ed), 2005, Pearson Prentice Hall.

A source of comparable material from around the world is:
http://www.roboticscourseware.org/courses.html

In this course, students are expected to take initiative for their own learning and these sites are a good place to start:

UNSW Library website: https://www.library.unsw.edu.au/
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

8. Course evaluation and development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include adjusting the total number of assessments and structuring of team evaluation for group assignments. Lecture slides have been updated to reflect more modern content, clarify notation and streamline content. Laboratory timeslots are nona(i)2.6 (-6.6 ( )no)10.5 (m)2.6 (y)8.9c re0 (as)-2 (s)-10.5 (f)-

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving