UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 2 2020

MMAN4200

ADDITIVE MANUFACTURING

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Xiaopeng Li
Tel: (02) 9385 6784
Email: xiaopeng.li@unsw.edu.au
Moodle: https://moodle.telt.unsw.edu.au/login/index.php
Microsoft Teams Video Chat Hours: Wednesday 1400-1700

Consultation concerning this course is available on Wednesday 1400 –1700, whenever the lecturer is not otherwise engaged. Contact preferred via email; consultation is by appointment only.

Contact details and consultation times for additional lecturers/demonstrators/lab staff

Junyan Chen junyan.chen@unsw.edu.au
Nasim Sabahi n.sabahi@student.unsw.edu.au
Xin Chi Kok x.kok@student.unsw.edu.au
Microsoft Teams Video Chat Hours: Wednesday 1400-1700

Please see the course Moodle.

2. Important links

- Moodle
- Lab Access
- Health and Safety
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering

3. Course details

Credit points

This is a 6 unit-of-credit (UoC) course and involves 3 hours per week (h/w) of scheduled online contact.

The normal workload expectations of a student are approximately 25 hours per term for each UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work.

You should aim to spend about 9 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	Delivery Mode
Lectures	Wednesday	1 hr/wk	Moodle Recorded Lectures
Demonstrations	Wednesday	10am – 12pm	Microsoft Teams Chat Channel
Lab	N/A	8 hrs/wk	See Moodle for details

All classes in T2 2020 will be online. Please consult this course's Moodle module for details about delivery.

Summary and Aims of the course

Additive manufacturing, also known as 3D printing, is an emerging advanced manufacturing technique which has enjoyed a rapid growth in recent years. It has been considered as a national strategic priority in many countries in Europe and North America, and this field of research is expected to grow even faster in the near future in Australia. Due to its layer-wise fabrication process, additive manufacturing is not only a disruptive technology that will complement many traditional manufacturing techniques but is also a major technique in the future to enable new business models, new products and new supply chains to flourish.

This course aims to provide an introduction to the fundamental and important aspects of additive manufacturing, in terms of additive manufacturing techniques, additive manufacturing process optimization and design for additive manufacturing. This course will also offer the students first-hand experience in additive manufacturing techniques.

The lectures from week 1 to 4 will focus on various additive manufacturing techniques up to date where you will gain basic knowledge about the history, development and fundamental engineering aspects of this technique. The lecture in week 8 will be a presentation on the lab project. The lecture in week 9 will cover additive manufacturing process optimization, including materials for additive manufacturing, properties of additive manufacturing fabricated components, and applications of additive manufacturing, e.g. aerospace, automotive, biomedical, and arts and design. Week 9 will also cover additive manufacturing design where you will use commercially available software to design advanced structures for additive manufacturing. The lectures in week 10 will introduce current major applications of additive manufacturing and provide a perspective for future development of this emerging manufacturing technique.

Aside from lectures and tutorials, this course also includes demonstrations where you will have first-hand experience in various additive manufacturing machines available in the School of Mechanical and Manufacturing Engineering.

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.	Understand the fundamental basis and nature of additive manufacturing techniques	PE1.1, PE 1.3, PE1.5, PE2.2, PE3.6
2.	Explain the principles and develop a systematic plan for additive manufacturing process optimisation	PE1.1. PE1.3, PE1.5, PE2.3, PE3.6
3.	Plan and execute appropriate design process for additive manufacturing	PE1.3, PE1.5, PE2.2, PE2.4, PE 3.2, PE3.6
4.	Be able to relate additive manufacturing to other manufacturing techniques	PE1.1, PE1.3, PE1.5, PE2.3, PE3.6

4. Teaching strategies

The subject will be presented in the form of online lectures, online demonstrations and online labs. Each weekly class will consist of 2 hours of a tutorial example or case study during lecture, related to the material covered in the previous lecture, followed by a 1 hour demonstration. One online lab project together with one online lab induction and training will also be included for students to have first-hand experience in additive manufacturing.

5. Course schedule

Week	Topic	Delivery Mode	Suggested Readings
1	Introduction to additive manufacturing	Online	Moodle Recorded Lecture/Class readings
2	Metal additive manufacturing	Online	Moodle Recorded Lecture/Class readings
3	Polymer additive manufacturing	Online	Moodle Recorded Lecture/Class readings
4	Ceramic additive manufacturing	Online	Moodle Recorded Lecture/Class readings
5,6,7	Online lab project and flexibility week		
8	A project study and design	Online	Moodle Recorded Lecture/Class readings
9	Additive manufacturing process optimisation and design for additive manufacturing	Online	Moodle Recorded Lecture/Class readings
10	Additive manufacturing applications and future of additive manufacturing	Online	Moodle Recorded Lecture/Class readings

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
Online quizzes	No	1 to 5 questions every week (Weeks 2,3,4,9,10)	10%	1, 2	Weekly lecture	Fortnightly, via Moodle	N/A	After the quiz closes
Assignment 1	No	Max 3000 words plus 10 references	25%	1, 2, 4	Lectures 1 to 4	Week 8	N/A	Week 11
Lab project	Yes	1 or 2 days	25%	1, 2, 3, 4	Refer to assignment details	Week 8	N/A	Week 11
Final exam	No	2 hours	40%	1, 2, 4	All course content from week 1 to 10, open book	Exam period, date TBC	N/A	Upon release of final results

Assignments

Assignment 1 requires each student or a group of students (depending on the number of the enrolled students) to write an essay based on given topics about additive manufacturing. The topics will be provided to the students in week 4.

For the online Lab project, students will be divided into several groups and a small, flexible project will be given to each group. Each project will be focused on polymer or metal additive manufacturing where you will need to design a real component for 3D printing. You will also need to talk about how your group work together to design and fabricate the component using 3D printers in your online group presentation. The assessment for the project will be based on the team's work, your understanding of the 3D printing process, and your group online presentation.

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

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 20 percent (20%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day.

Work submitted after the 'deadline for absolute fail' is not accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These are clearly indicated in the course outline, and such assessments receive a mark of zero if not completed by the specified date. Examples include:

a. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
b. Online quizzes where answers are released to students on completion, or
c. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
d. Pass/Fail assessment tasks.

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

You must be available for all quizzes, tests and examinations.

Final examinations for each course are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates.

For further information on exams, please see the Exams webpage.

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 attempt 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 the information on UNSW's Special Consideration page.

7. Expected resources for students

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.

9. Academic honesty and plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis) even suspension from the university. The Student Misconduct Procedures are available here: www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

10. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

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
	PE2.2 Fluent application of engineering techniques, tools and resources
	PE2.3 Application of systematic engineering synthesis and design processes
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (professional and lay domains)
	PE3.3 Creative, innovative and pro-active demeanour
	PE3.4 Professional use and management of information
	PE3.5 Orderly management of self, and professional conduct
	PE3.6 Effective team membership and team leadership