



Mechanical and Manufacturing Engineering

Course Outline

Term 2 2020

MECH9650

MICRO- AND BIOFLUIDICS

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1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr Susann Beier

Tel: (02) 9385 57580

Email: s.beier@unsw.edu.au

Moodle: <https://moodle.telt.unsw.edu.au/course/view.php?id=52294>

Microsoft Teams Video Chat Hours: Wednesdays 3-4pm via teams.

Please contact me via teams if you have questions or post it on the forum for all students to learn.

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 2 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 8 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	TBA	1 hrs/wk	Online Lectures (Moodle Recorded)
Demonstrations	TBA	1 hrs/wk	Microsoft Teams

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

This course introduces the fundamentals of micro- and biofluidics and its basic theory on fluid dynamics. We will learn about micro- and nanoscale fluidics devices and their fabrication as well as important modeling and experimental techniques used in relevant fields, especially biofluidics research.

The aim of the course is to give the students an insight into the research that can be conducted with micro- and biofluidic modelling and experiments. Starting with understanding special fluid properties that develop at micro- and nanoscale, all the way to predicting disease conditions in the human body and designing implants to prevent those conditions. A broad introduction into the field of micro and biofluidics is provided and students will learn about diversity and significance of the field.

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.	Understanding the difference between macro- and microfluidics and how it is especially relevant to a range of biological systems.	PE1.1-PE1.6
2.	Fabricate and analyse a fluidics device using current best practice to apply the theory learned	PE.1.5, PE.1.6, PE.2.1
3.	Learning how to compute fluidics problems by applying the techniques, skills and modern engineering tools learned	PE2.1-PE2.4
4.	Successfully design and analyse a microfluidics device of sufficient complexity to give insight into practical applications of the methods	PE2.1-2.4

Learning Outcome		EA Stage 1 Competencies
5.	Present and discuss a device or component in this research space including its end-to-end fabrication, and its capability to meet desired need within realistic biological constraints such as economic, environmental, social, health and safety, manufacturability, and sustainability	PE3.1-3.6

4. Teaching strategies

Private Study	<ul style="list-style-type: none"> - Review lecture material and notes - Do set problems and assignments - Reflect on class problems and assignments - Practice the quizzes - Keep up with notices and find out marks via Moodle - Read and work with the provided material
Lectures	<ul style="list-style-type: none"> - Find out what you must learn - Follow worked examples - Hear announcements on course changes - Ask questions
Tutorial time	<ul style="list-style-type: none"> - Be guided by demonstrators - Follow worked examples - Practice solving provided problems - Work in a team - Ask questions - Practice a community of learning with your peers
Practice questions	<ul style="list-style-type: none"> - Reflect on your knowledge and skills - Gain greater understanding and problem-solving ability - Participate in weekly review questions

5. Course schedule

Week	Topic	Delivery Mode	Suggested Readings	Assessment
1	Course Introduction	Online		
2	Macro fluidics	Online	Biofluid Mechanics: Chapter 1, 2, 3	
3	Micro fluidics	Online	Biofluid Mechanics: Chapter 1, 2, 3	Assignment 1: Team based, make a paper-based microfluidics device, video (20%) - peer reviewed

Week	Topic	Delivery Mode	Suggested Readings	Assessment
4	Bio fluidics	Online	Biofluid Mechanics: Chapter 4, 5	
5	Micro and Biofluidic devices	Online		Quiz 1 (30%) - 35 Q (hard) on W1-4
6	<i>Study week</i>			
7	Fabrication of Micro and Biofluidic devices	Online		
8	In vitro	Online	Biofluid Mechanics: Chapter 15	Quiz 2 (20%) - 25 Q on W5-7
9	In silico	Online	Biofluid Mechanics: Chapter 14	Assignment 2: Poster and Presentation on microdevice/biodevice, their theory, application, importance (20%) - peer reviewed
10	Summary	Online		
				<i>No final EXAM</i> 10% Contribution mark

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
Micro-fluidics paper-based device**	Yes (5-6)	Video, 3-5 minutes	20%	2, 3, 4 and 5	Peer reviewed, topics assessed include design, execution, analysis, complexity, and creativity	Week 3, Friday 5pm via Moodle	Week 4, Monday 5pm	1 week after submission
Quizzes (2)	No	60 minutes each	50% (30% Q1 and 20% Q2)	1	Lecture materials from weeks 1-4 (Quiz 1) and 5-7 (Quiz 2)	Week 5 and 8	N/A	The day after each quiz
Virtual conference – Micro- and Biofluidic research**	Yes (2)	Virtual Conference - Recorded presentation and poster	20%	1, 2 and 3	All course content from weeks 2-10	Week 9, Friday 5pm via Moodle	Week 10, Monday 5pm	1 week after submission
Contribution	No	Throughout the course	10%	1 - 5	Lecture and tutorial participation, peer review	Marked throughout the course	N/A	End of term

**Students receive separate marks based on their individual contribution for group assessments.

Assignments

Micro-fluidics paper-based device

The students will design and analyse a microfluidics paper-based device with freely available material and school resources. The students will undertake this in teams and will present their work in form of a video.

Quizzes

The students will be asked to calculate relevant problem scenarios and answer basic to complex questions to demonstrate their understanding of the difference between macro and microfluidics and their relevance for biological systems.

Micro- and Biofluidics resreach – virtual conference

The students will present a state of the art biofluidic problem and related fluidics device to meet a need and overcome a real-life problem. The teams of students can choose from a range of latest research to present, discuss and evaluate these devices.

Contribution

Additional digital support material and a visual lab tour relates to micro-device fabrication, ANFF lab, 3D printing and micro-mixer simulation are provided. Participation and interest in these materials as well as teamwork will contribute towards to student's Contribution score.

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.

Quizzes

Students are expected to work on their own laptop. The quizzes will be done on the student's own device and have a time limit. Students can use papers, pens and calculators to help solving some of the questions, however no other material is permitted.

Examinations

You must be available for all tests and participate in group work. Substitute assessments may not be possible due to the nature of the assessment.

There will be no final exam.

Calculators

You will need to provide your own calculator, of a make and model approved by UNSW, for the examinations. The list of approved calculators is shown at

student.unsw.edu.au/exam-approved-calculators-and-computers

It is your responsibility to ensure that your calculator is of an approved make and model, and to obtain an "Approved" sticker for it from the [Engineering Student Support Services Centre](#) prior to the examination. Calculators not bearing an "Approved" sticker will not be allowed into the examination room.

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

Each student is expected to bring their own laptops to each lecture and tutorial. Please make sure you are able to use Microsoft Office and ANSYS CFD on your laptop which is available through MyAccess.

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 tutorial contents, quiz contents, and contribution assessment.

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 policies. 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