UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Semester 2 2018

MECH9650

INTRODUCTION TO MICRO ELECTROMECHANICAL SYSTEMS

Contents

1. Staff contact details

Contact details and consultation times for course convenor

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Please come and see us in person if you have questions rather than sending an email.

Please see the course Moodle.

2. Important links

- Moodle
- UNSW Mechanical and Manufacturing Engineering
- Course Outlines
- Student intranet
- UNSW Mechanical and Manufacturing Engineering Facebook
- UNSW Handbook

3. Course details

Credit Points

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

The UNSW website states "The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week."

This means that 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	Location
Lectures	Tuesdays	6pm - 7pm	Physics Theatre (K-K14-19)
Demonstrations and Lab	Tuesdays	7pm – 9pm	Physics Theatre (K-K14-19), Computer labs, UTL (*announced on the day*)

Summary and Aims of the course

This course introduces the fundamentals of Micro Electromechanical systems (MEMS) and its applications in a wide range of devices and systems, as well as the design and simulation of these systems. MEMS is an enabling technology which has been penetrated into and begun to change the way major discipline do things, including biotechnology, storage technology, instrumentation, optical communications, telecommunications, MEMS device packaging, etc.

The aim of the course is to give the students hands on experience about the learning field of MEMs. This is a blended learning course meaning that the student's learning will be largely self-driven in the time outside the scheduled face-to-face time. A broad introduction to the field of MEMs is provided and students will learn about diversity and significance of the field. A focus will be fabrication and microfluidics. By the end the students will understand, fabricate and compute their own MEMs system device for analysis.

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 a range of technologies used in micro-fabrication and machining methods from a range of real life examples	PE1.1-PE1.6
2.	Fabricate a micro-fluidics system or component using available school facilities by applying the theory learned	PE1.5, PE1.6, PE2.1
3.	Compute micro-fluidics problems by applying the techniques, skills, and modern engineering tools learned	PE2.1- PE2.4
4.	Execute a successful analysis of a MEMS problem of sufficient complexity to give insight into practical applications of the methods	PE2.1- PE2.4

Learning Outcome		EA Stage 1 Competencies
5.	Complete an end-to-end micro-fluidics system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, health and safety, manufacturability, and sustainability	PE3.1-3.6

4. Teaching strategies

Private Study	- 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
Mini lectures	- Find out what you must learn - Follow worked examples - Hear announcements on course changes
Tutorial time	- Be guided by Demonstrators - Practice solving problems - Work in a team - Ask questions - Practice a community of learning with your peers
Weekly practice quizzes	- Reflect on your knowledge and skills - Gain higher understanding and problem solving ability

5. Course schedule

Week	***Topic***	***Activity***	***Location***	***Suggested Readings***
Week 1	Course structure, end-to-end case study, learning outcomes, Etiquette, Why is MEMs important?	- What to expect - working with the online content, online learning community - Team formation, team building activity - Orientation discussion - Practice quiz tools using assumed entry level knowledge	Physics Theatre	
Week 2	Microfluidics design and devices – An overview	Design, planning, engineering sketch	Physics Theatre, Computer labs	Online material for that week

Week	*Topic*	*Activity*	*Location*	*Suggested Readings*
Week 3	Fabrication I: Intro, Photo-lithography, Thin Film Processes	CAD drawing	Physics Theatre, Computer labs	Online material for that week
Week 4	Fabrication II: bulk silicone, surface and other micro-machining	Lab tour, fabrication of device	Physics Theatre, UTL	Online material for that week
Week 5	Fabrication III: Nanomachining and edging	Lab tour, fabrication of device	Physics Theatre, UTL	Online material for that week
Week 6	Intro CFD	Facilitated discussion, and analysis	Physics Theatre, Computer labs	Online material for that week
Week 7	Fluids I	Experimental testing and model analysis	Physics Theatre, UTL	Online material for that week
Week 8	Fluids II	Demo PhD projects	Physics Theatre	Online material for that week
Week 9	Microfluidics analysis techniques	Demo PhD projects	Physics Theatre	Online material for that week
Week 10	What it means to work in the field	Guest Lecture - tbc	Physics Theatre	
Week 11	Applications - Sensors	Guest Lecture Prof Kwok, Electrical Engineering	Physics Theatre	
Week 12	Applications - Needles, Filters	Guest Lecture Dr Robert Norton, School of Biomedical Sciences	Physics Theatre	

6. Assessment

Assessment overview

Assessment	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Group report	5000 words	30%	2, 3, 4 and 5	Peer assessment, topics assessed include design, execution, analysis, and report writing skills	Midnight, Friday 28th September via Moodle	Midnight Monday 1st October	2 weeks after submission
Assessment Quizzes (2)	10 multiple choice each	20% (10% each)	1	Lecture material from weeks 2-5 (A.Quiz 1) and 6-9 (A.Quiz 2)	In week 5, and 9	N/A	The class after each assessment (i.e. weeks 6, and 10)
Final exam	2 hours	50%	1, 2 and 3	All course content from weeks 2-12 inclusive.	Exam period, date TBC	N/A	Upon release of final results

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

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 20 per cent (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 tests and examinations. Final examinations for each course are held during the University examination periods, which are June for Semester 1 and November for Semester 2.

Provisional Examination timetables are generally published on myUNSW in May for Semester 1 and September for Semester 2

For further information on exams, please see the Exams section on the intranet.

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 School Office or the Engineering Student Centre prior to the examination. Calculators not bearing an “Approved” sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

For details of applying for special consideration and conditions for the award of supplementary assessment, 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: 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

Further information on School policy and procedures in the event of plagiarism is available on the intranet.

10. Administrative matters and links

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

- Attendance, Participation and Class Etiquette
- UNSW Email Address
- Computing Facilities
- Assessment Matters (including guidelines for assignments, exams and special consideration)
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Student Support 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