



UNSW

UNSW Course Outline

MECH9420 Composite Materials and Mechanics - 2024

Published on the 02 Feb 2024

General Course Information

Course Code : MECH9420

Year : 2024

Term : Term 1

Teaching Period : T1

Is a multi-term course? : No

Faculty : Faculty of Engineering

Academic Unit : School of Mechanical and Manufacturing Engineering

Delivery Mode : In Person

Delivery Format : Standard

Delivery Location : Kensington

Campus : Sydney

Study Level : Undergraduate, Postgraduate

Units of Credit : 6

Useful Links

[Handbook Class Timetable](#)

Course Details & Outcomes

Course Description

Using a unified and integrated approach, this course will give you a solid grounding in:

- The properties of composite materials;

- Processing and manufacturing methods;
- Micromechanics and lamination theory;
- The analysis and manufacture of light weight composite structures;
- The design of a composite structures;
- Test methods to confirm mechanical properties.

The course will cater to the specific challenge of materials engineers across all engineering disciplines:

- Aerospace
- Manufacturing
- Civil & Mechanical Engineering
- Mechatronics
- Naval Architecture
- Architecture
- Industrial Design

Course Aims

The course aims to reinforce students' understanding of core mechanical engineering principles as well as building their capabilities in core mechanical engineering practice.

In particular, the course will develop a solid understanding of the properties of composite materials, micromechanics and lamination theory, together with the analysis and manufacture of lightweight composite structures in a unified and integrated manner for an undergraduate/postgraduate student.

The development of practical laboratory and professional skills, complements the strengthening of mechanical engineering and related programs such as aerospace engineering, naval architecture knowledge through the practical experience of a range of unit operations.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Understand the mechanical properties of FRP composite materials and the micromechanics and lamination theory of composites
CLO2 : Manufacture composite laminate by resin infusion process and test their mechanical properties
CLO3 : Understand the current status of characterization of composite structures and applications of FRP composites

Course Learning Outcomes	Assessment Item
CLO1 : Understand the mechanical properties of FRP composite materials and the micromechanics and lamination theory of composites	• Test 1 and 2
CLO2 : Manufacture composite laminate by resin infusion process and test their mechanical properties	• Assignment 2 • Assignment 3
CLO3 : Understand the current status of characterization of composite structures and applications of FRP composites	• Assignment 1

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | Echo 360

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment 1 Assessment Format: Individual	15%	Due Date: March 8th, Friday, 17:00
Test 1 and 2 Assessment Format: Individual	40%	Due Date: Wednesday 18:00-19:00 Week 4 and Week 10
Assignment 2 Assessment Format: Group	25%	Due Date: Friday, 17:00, Week 9
Assignment 3 Assessment Format: Group	20%	Due Date: Friday 17:00 Week 10

Assessment Details

Assignment 1

Assessment Overview

Assignment 1 (Individual)

You are required to complete a research review on an application topic of polymer composites related to your study program (i.e. aerospace, mechanical, mechatronics, naval, manufacturing engineering, biomedical engineering, etc.).

You are required to review at least 5 journal articles (written in English only) on your topic and make credible review of the topic highlighting the use of material, mechanics and manufacturing techniques for engineering applications. Your report is limited to 10 pages (5000 words) with 1.5-spacing, not including the references page, with Times New Roman at 12 pts and the

standard margins (3 cm for the top and 2.54 cm for the rest). NO LATE SUBMISSIONS CAN BE ACCEPTED FOR THIS ASSIGNMENT.

Assessment criteria

Assignments

Purpose

We need to find out how well you have:

- grasped the fundamentals of micro-mechanics of composites
- become proficient in developing your understanding for engineering applications
- become proficient in calculation layout and development
- developed correct, professional technique
- become proficient in using composite materials fundamentals to solve practical problems and apply
- come to see the world through “engineers’ eyes”
- prepared yourself for your future career

Scheme

The final grade in MECH9420 will be based on the sum of the scores from each of the assessment components.

- Final grades may be adjusted by scaling with the approval of the appropriate departmental meeting.
- A pass in this course requires a mark of 50% in both assessments and Class Tests.

Assignments will be returned in 2 weeks after submission. 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. Feedback from a previous instance of the course suggested that a large number of small assessment tasks were conducive to continued hybrid learning and this has been maintained.

Course Learning Outcomes

- CLO3 : Understand the current status of characterization of composite structures and applications of FRP composites

Detailed Assessment Description

Deadline for absolute fail is 5 calendar days after due time

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Test 1 and 2

Assessment Overview

- Use the basic concepts of micro- and macro-mechanics of
- Systematic approach to outline the steps for a problem and use the necessary fundamental concepts covered in the lectures and problem-solving classes.
- Correctness of the solution with the aid of necessary diagrams/sketches and the use of appropriate units.

Test 1 (20% marks) will be held on week 4 to understand the course content of week 1 to 3. Test 2 (20% marks) will be held on week 10 to understand the course content of week 4 to 9. The test results will be released in 2 weeks time.

If you have experienced an illness or misadventure beyond your control that has interfered with your assessment performance, you are eligible to 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.

Course Learning Outcomes

- CLO1 : Understand the mechanical properties of FRP composite materials and the micromechanics and lamination theory of composites

Assignment 2

Assessment Overview

Assignment 2 and 3 (Group, 6-7 students per group)

These assignments are experimental reports on manufacture and characterisation of mechanical properties of composite laminate samples. The length of the report should be 8 pages plus additional 5 pages for graphs/plots and discussions. These assignments will be returned in 2 weeks.

Assessment criteria

Assignment/ Laboratory Reports

- Hands-on sample manufacture, tensile tests of composites, report writing and communication skills

- Interpretation of the experimental results for the required information described in the handout for each experiment.
- Understanding the relationship between the theory covered during the lectures and experimental results in the laboratory.
- Presentation of the report in accordance with the MECHENG guidelines.
- Attendance and participation during the laboratory experiments.

Course Learning Outcomes

- CLO2 : Manufacture composite laminate by resin infusion process and test their mechanical properties

Detailed Assessment Description

Deadline for absolute fail is 5 calendar days after due date

Assignment 3

Assessment Overview

Assignment 2 and 3 (Group, 6-7 students per group)

These assignments are experimental reports on manufacture and characterisation of mechanical properties of composite laminate samples. The length of the report should be 8 pages plus additional 5 pages for graphs/plots and discussions.

Assessment criteria

Assignment/ Laboratory Reports

- Hands-on sample manufacture, tensile tests of composites, report writing and communication skills
- Interpretation of the experimental results for the required information described in the handout for each experiment.
- Understanding the relationship between the theory covered during the lectures and experimental results in the laboratory.
- Presentation of the report in accordance with the MECHENG guidelines.
- Attendance and participation during the laboratory experiments.

Course Learning Outcomes

- CLO2 : Manufacture composite laminate by resin infusion process and test their mechanical properties

Detailed Assessment Description

Deadline for absolute fail is 5 calendar days after due date

General Assessment Information

Assessment Criteria

Assignment/ Laboratory Reports

- Interpretation of the experimental results for the required information described in the handout for each experiment.
- Understanding the relationship between the theory covered during the lectures and experimental results in the laboratory.
- Presentation of the report in accordance with the MECHEENG guidelines.
- Attendance and participation during the laboratory experiments.

Tests

- Use the basic concepts of micro- and macro-mechanics of structures.
- Systematic approach to outline the steps for a problem and use the necessary fundamental concepts covered in the lectures and problem-solving classes.
- Correctness of the solution with the aid of necessary diagrams/sketches and the use of appropriate units.

Test 1 (20% marks) will be held on week 4 to understand the course content of week 1 to 3. Test 2 (20% Marks) will be held on week 10 to understand the course content of week 4 to 9.

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

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.

Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that has interfered with your assessment performance, you are eligible to 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.

Grading Basis

Standard

Requirements to pass course

The final grade in MECH9420 will be based on the sum of the scores from each of the assessment components.

- Final grades may be adjusted by scaling with the approval of the appropriate departmental meeting.
- A pass in this course requires a mark of 50% in both assessments and Class Tests.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	Introduction to Composite Materials
Week 2 : 19 February - 25 February	Lecture	Composite Constitutes and Composite Manufacturing Assignment 1 issued-a review document on composite materials-applications, relevant to your degree program. Submission due in Week 4 (15%)
Week 3 : 26 February - 3 March	Lecture	Manufacturing of Fibre Reinforced Composites and Micromechanics I
	Tutorial	- Sample problem solving class
	Laboratory	Resin infusion for composite laminate manufacture
Week 4 : 4 March - 10 March	Lecture	Micromechanics II
	Tutorial	- Sample problem solving class Assignment 2 issued- report on the materials, manufacturing method and characterisation. Submission due in Week 7 (25%)
	Assessment	Test 1-20% Lecture notes (week 1-3)
Week 5 : 11 March - 17 March	Lecture	Lamina
Week 6 : 18 March - 24 March	Other	Flexi week
Week 7 : 25 March - 31 March	Lecture	Composite Laminates • Classical laminate theory • Laminate stiffness coupling effects • Engineering constants of laminates
	Tutorial	-Sample problem solving class
Week 8 : 1 April - 7 April	Lecture	Strength and Modelling • Determination of stress and strain in lamina • Failure mechanisms • Failure theories • Environmental effects • Introduction to composite FEA
	Laboratory	Composite sample test
	Tutorial	-Sample problem solving class
Week 9 : 8 April - 14 April	Lecture	Design of Laminates, Standards and Test
	Laboratory	Composite sample test Assignment 3 issued- report on the materials and mechanical (flexural) properties of laminates. Submission due in Week 10 (20%)
	Tutorial	-Sample problem solving class
Week 10 : 15 April - 21 April	Lecture	Structure Health Monitoring and NDT Methods
	Assessment	Test 2- 20% Lecture notes (week 4-9)

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Resources

Prescribed Resources

Expected resources for students

Reference texts

UNSW Library website: <https://www.library.unsw.edu.au/>

Moodle: <https://moodle.telt.unsw.edu.au/login/index.php>

Recommended Resources

Reference texts

1. Isaac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, Oxford University Press, 1994.
2. Mel M. Schwartz, Composite Materials, Vol 2, Prentice Hall, New Jersey, 1997.
3. R. A. Shenoi and J. F. Wellicome, Composite Materials in Maritime Structures, Vol 1&2, Cambridge University Press, U.K., 1993.

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.

Feedback from a previous instance of the course suggested that a large number of small assessment tasks were conducive to continued online learning and this has been maintained. Prior to that, improvements included moving to a single platform for online content delivery and assessment.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Jin Zhang		Office 311J, Building J17	(02) 93854090	Email or Teams. In-person meeting will be booked by email.	No	Yes
Lecturer	Garth Pearce		Office 208E, Building J17	(02) 93854127	Email or Teams. In-person meeting will be booked by email.	No	No

Other Useful Information

Academic Information

I. 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, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, 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](#).

II. 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](#)

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: <https://www.unsw.edu.au/engineering/student-life/student-resources/program-design>.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published.

Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

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.

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 or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) 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. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be 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 will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

Short Extensions

Short extensions are not currently applicable to Mechanical and Manufacturing Engineering Courses.

Review of Results

The purpose of a review of results is if there was a marking error. Review of results is for when you have cause to believe that there is a marking error. Review of Results cannot be used to get feedback. If you would like feedback for assessments prior to the final exam, you are welcome to contact the course convenor directly. No feedback will be provided on final exams.

Use of AI

The use of AI is prohibited unless explicitly permitted by the course convenor. Please respect this and be aware that penalties will apply when unauthorised use is detected, such as through Turnitin. If the use of generative AI, such as ChatGPT, is allowed in a specific assessment, they must be properly credited, and your submissions must be substantially your own work.

School Contact Information

Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

Hours

9:00–5:00pm, Monday–Friday*

*Closed on public holidays, School scheduled events and University Shutdown

Web

[School of Mechanical and Manufacturing Engineering](#)

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

(+61 2) 9385 4097 – School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

School Office – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries. The School will only be able to refer students on to the relevant team if contacted

Important Links

- [Student Wellbeing](#)
- [Urgent Mental Health & Support](#)
- [Equitable Learning Services](#)
- [Faculty Transitional Arrangements for COVID-19](#)
- [Moodle](#)
- [Lab Access](#)
- [Computing Facilities](#)
- [Student Resources](#)
- [Course Outlines](#)
- [Makerspace](#)
- [UNSW Timetable](#)
- [UNSW Handbook](#)