UNSW SYDNEY

UNSW Engineering

Education Specification

1. Program Overview

Program Title: Master of Engineering (ME)

Award Title: Master of Engineering (Mechanical Engineering)

Engineering Discipline: Mechanical Engineering

UNSW Master of Engineering (Mechanical Engineering) is a two-year (full-time equivalent) flexible degree delivered by the School of Mechanical and Manufacturing Engineering. The degree is AQF level 9 and provides graduates with specialised knowledge and skills for research, and/or professional practice and/or further learning.

The report begins by addressing the specialisation's overall aims and its uniqueness. It then covers the specialisation plan, followed by the Specialisation Learning Outcomes. The process for developing and obtaining feedback to improve these SLOs is detailed. This is followed by the curriculum mapping that relates the individual courses to the Specialisation Learning Outcomes, the Specialisation Learning Outcomes to the Graduate Capabilities and the individual courses to the Graduate Capabilities.

2. Career Alignment

The Mechanical Engineering specialisation is intentionally designed to equip graduates with the technical depth, professional capabilities, and industry awareness needed to thrive in a broad range of engineering roles. The curriculum integrates fundamental mechanical engineering principles with advanced manufacturing technologies and management concepts, reflecting evolving industry expectations and the increasing emphasis on digital, automated, and sustainable manufacturing systems.

Alignment with Industry Sectors and Career Pathways

The specialisation prepares students for careers across multiple established and emerging sectors, including:

- Advanced manufacturing and automation
  (robotic manufacturing systems, CNC machining, Industry 4.0 technologies, digital production environments)
- Energy and infrastructure
  (thermal systems, rotating machinery, energy efficiency, system design and optimisation)
- Transport and automotive systems
  (vehicle design, materials selection, reliability engineering, and production processes)
- Aerospace and defence engineering
  (high-performance materials, precision manufacturing, systems integration)

- Sustainable and low-waste manufacturing
  (life-cycle analysis, process optimisation, and resource-efficient production)

Preparation for Professional Roles

Graduates are well prepared for a range of mechanical and manufacturing engineering roles, including:

- Mechanical Design Engineer
- Manufacturing or Process Engineer
- Production and Operations Engineer
- CAD/CAM or Digital Manufacturing Engineer
- Industrial and Systems Engineer
- Reliability and Maintenance Engineer
- Supply Chain and Operations Analyst

The integration of engineering management concepts also ensures students can progress into supervisory or strategic roles over time.

Industry-Informed Curriculum

The structure of the specialisation is shaped by:

- Regular consultation with industry experts, ensuring relevance to current technologies, workplace practices, and emerging skill needs.
- Emphasis on digital manufacturing tools, including CAD/CAM (e.g., SolidWorks, Fusion 360) and CNC programming, reflecting growth in automation and computational design.
- Exposure to data-driven decision making, preparing graduates for environments where engineering decisions rely on simulation, optimisation, and performance modelling.
- A balanced curriculum that combines mechanical fundamentals, manufacturing technologies, and engineering management, giving graduates both technical depth and commercial awareness.

Professional Expectations

Students develop key capabilities aligned with professional engineering standards, including:

- Technical competence across mechanics, thermofluids, materials, and manufacturing processes.
- Ability to design, analyse, and optimise products and systems for performance, cost, and sustainability.
- Strong teamwork, project management, and communication skills, reflecting typical multidisciplinary engineering environments.
- Awareness of safety, risk, ethical practice, and the environmental impacts of engineering decisions.

3. Specialisation Framework

The School Education Committee drafted the Stream Learning Outcomes (SLOs), specifically the Stream Coordinators for each of our accredited BE and ME streams. The drafts were developed considering benchmarking conducted for the 2021 accreditation report, feedback from industry partners, and expectations for graduate outcomes aligned with EA Stage 1 competencies.

The draft SLOs were reviewed and aligned by the Deputy Head of School (Education) before being presented to the School Education Committee for endorsement. The School Industry Advisory Board (IAB) consultation was sought in writing, followed by a follow-up workshop.

The ME(Mechanical) and BE(Mechanical) share a common core of knowledge but aim at different levels of mastery and achievement. The similarities and differences in the graduate outcomes are reflected in the respective SLOs. In many cases, the topics are similar, yet the level is reflected in more advanced verbs that describe greater mastery of the subject and/or professional skill.

On successful completion of the MECHBS8621 program, graduates will be able to:

SLO1	Demonstrate mastery of advanced technical knowledge in mechanical engineering disciplines such as thermodynamics, mechanics of both solids and fluids, design, manufacturing and advanced materials.
SLO2	Recognise and comply with the national and international standards and regulatory environment which practicing Mechanical Engineers operate within.
SLO3	Evaluate and create analytical and computational tools, both general and specialised, to solve advanced problems in mechanical engineering.
SLO4	Create innovative engineering solutions to complex problems in mechanical engineering based on rigorous analysis and synthesis of current research.
SLO5	Develop and implement management strategies for multidisciplinary engineering projects.
SLO6	Lead mechanical engineering projects, individually or as part of a team, in a systematic and professional manner.
SLO7	Advance the ethical and sustainable practice of mechanical engineering.
SLO8	Communicate professionally and effectively across multi-disciplinary engineering teams.

4. Continuous Improvement

- Curriculum Revision
    - The School undertakes regular curriculum reviews to ensure alignment with emerging technologies, sector priorities, and professional accreditation competencies.
    - Particular attention is being given to strengthening Engineers Australia Competency 3.6 (Teamwork). A new course is currently in development that will explicitly focus on team-based engineering design, providing structured opportunities for students to practice collaborative problem-solving and multidisciplinary teamwork.
    - Curriculum updates are informed by feedback from academic staff, industry partners, and students, ensuring responsiveness to both professional expectations and learning needs.
- Assessment

  - To better reflect real engineering practice, the School is expanding the breadth of assessment types used across the program.
  - Beyond traditional examinations, the School is piloting more individualised, authentic assessment models, including:
    - Open-ended design or investigative projects
    - Individual portfolios demonstrating progressive skill development
    - Viva examinations to assess depth of understanding and academic integrity
  - These innovations aim to strengthen students' problem-solving, communication, and reflective capabilities while ensuring robust measurement of individual achievement.
- Continuous Improvement
  - The School Education Committee and the Industry Advisory Network review curriculum-mapping outcomes and provide targeted recommendations for improvement.
  - These committees oversee annual revisions to course content, Student Learning Outcomes (SLOs), and curriculum mapping, ensuring that the program remains adaptive to changes in the engineering profession.
  - The School has institutionalised student–staff feedback sessions each term, providing structured, real-time opportunities for students to raise concerns, propose enhancements, and co-shape the learning environment. Insights from these sessions feed directly into teaching practice, course design, and annual program review cycles.

5. Review Process

UNSW's Academic Offering Review and Monitoring Procedure outlines a structured approach to maintaining the quality and relevance of academic programs and courses. It includes both program-level and course-level review processes, with defined responsibilities and timelines.

Program Monitoring is conducted annually for all programs and specialisations. A comprehensive program review must occur at least once every five years for accredited programs, and every seven years for others. These reviews include a self-evaluation report (SER), review panel, review event, and a formal response with an implementation plan. Oversight is provided by the Academic Board and University Academic Quality Committee (UAQC), with input from Faculty Education Committees and Deans.

Course Review within UNSW Engineering is managed through a two-tiered process: Routine Course Review and Comprehensive Course Review. Routine reviews are conducted at the end of each term by Schools, using data such as enrolment, assessment outcomes, academic integrity issues, WAM differences, and student feedback (myExperience). Courses flagged through this process are added to the Comprehensive Course Review roster.

Comprehensive Course Reviews are detailed evaluations led by the Course Convenor in collaboration with a Faculty Educational Developer, Nexus Fellow, or Senior Academic. These reviews assess course design, pedagogy, alignment with learning outcomes, and feedback mechanisms. Outcomes are documented in a Course Development Plan and an Evaluation Report following the next course delivery. Schools must review at least 10% of their courses annually.

Stakeholder involvement spans multiple levels, including the Academic Board, UAQC, Faculty and School committees, Course Convenors, and external contributors such as students and professional bodies.

Frequency of updates includes termly course reviews, annual program monitoring, and five-yearly comprehensive reviews for accredited programs.

6. Curriculum Mapping

SLO 1 (Advanced Technical Knowledge) & SLO 3 (Analytical Tools): These core technical competencies are rigorously developed through the mandatory core course MECH4100 (Mechanical Design 2) and advanced Level 4 and 5 electives. For example, MECH4620 (Computational Fluid Dynamics) and MMAN4410 (Finite Element Methods) require students to create and evaluate specialised computational tools to solve complex problems. MECH4305 (Advanced Vibration Analysis) and MECH4880 (Refrigeration and Air Conditioning) ensure mastery of specific mechanical disciplines.

SLO 2 (Standards & Regulations) & SLO 7 (Ethical Practice): Recognition of regulatory environments and ethical practice is embedded in the core design course MECH4100, where students must design to Australian Standards. It is further reinforced in Engineering and Technical Management (ETM) electives such as GSOE9340 (Life Cycle Engineering), which focuses on sustainability, and MANF4430 (Reliability and Maintenance Engineering), which deals with safety-critical systems.

SLO 4 (Innovative Solutions) & SLO 5 (Management Strategies): Innovation and management are key differentiators of the Masters program. MMAN4400 (Engineering Management) and GSOE9820 (Engineering Project Management) explicitly teach the strategies required to manage multidisciplinary projects. The capstone Masters Project (MMAN9451/2/3) requires students to create innovative solutions based on a rigorous synthesis of current research.

SLO 6 (Leadership) & SLO 8 (Communication): Leadership is assessed through team-based projects in MECH4100 and MMAN4400. High-level professional communication is a mandatory outcome of the research thesis, where students must defend their work to a technical audience.

The course learning outcomes in the Master of Mechanical Engineering (MECHBS) are somewhat uniformly developed across the different EA Stage 1 Competencies. More so than the undergraduate streams, there is substantial weight allocated to application-focused capabilities (Cat 2), with less emphasis on knowledge development (Cat 1).

There is a weakness in the development of teamwork skills (Competency 3.6) relative to the other competencies. This graduate capability has generally not been a strong focus of Master's coursework, with more emphasis on management and leadership. The School is addressing this issue by developing intense cornerstone coursework in the first year of the program. We have well-developed plans to deliver a cornerstone design experience (analogous to the DESN1000 course for UG students) with an emphasis on teamwork and cohort building.

Table 1. Mapping of the stream learning outcomes to the Engineers Australia Stage 1 Competencies

SLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14.	PLO15	PLO16
1. Demonstrate mastery of advanced technical knowledge in mechanical engineering disciplines such as thermodynamics, mechanics of both solids and fluids, design, manufacturing and advanced materials.	x	x	x				x	x								
2. Recognise and comply with the national and international standards and regulatory environment which practicing Mechanical Engineers operate within.	x	x	x		x	x		x	x							
3. Evaluate and create analytical and computational tools, both general and specialised, to solve advanced problems in mechanical engineering.			x	x	x		x	x								
4. Create innovative engineering solutions to complex problems in mechanical engineering based on rigorous analysis and synthesis of current research.			x	x			x	x	x				x			
5. Develop and implement management strategies for multidisciplinary engineering projects.			x	x	x			x	x	x				x		
6. Lead mechanical engineering projects, individually or as part of a team, in a systematic and professional manner.				x	x	x				x			x	x	x	x
7. Advance the ethical and sustainable practice of mechanical engineering.					x	x				x	x			x	x	
8. Communicate professionally and effectively across multi-disciplinary engineering teams.					x	x			x	x		x		x	x	x

Table 2. Mapping of courses to the stream learning outcomes

CLO	1. Demonstrate mastery of advanced technical knowledge in mechanical engineering disciplines such as thermodynamics, mechanics of both solids and fluids, design, manufacturing and advanced materials.	2. Recognise and comply with the national and international standards and regulatory environment which practicing Mechanical Engineers operate within.	3. Evaluate and create analytical and computational tools, both general and specialised, to solve advanced problems in mechanical engineering.	4. Create innovative engineering solutions to complex problems in mechanical engineering based on rigorous analysis and synthesis of current research.	5. Develop and implement management strategies for multidisciplinary engineering projects.	6. Lead mechanical engineering projects, individually or as part of a team, in a systematic and professional manner.	7. Advance the ethical and sustainable practice of mechanical engineering.	8. Communicate professionally and effectively across multi-disciplinary engineering teams.
Core Course								
MECH4100 Mechanical Design 2		Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
Level 4 Electives								
MANF4430 Reliability and Maintenance Engineering	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	
MECH4305 Fundamental and Advanced Vibration Analysis	Proficient	Proficient	Developed	Developed	Introduced			Developed
MECH4320 Engineering Mechanics 3								
MECH4620 Computational Fluid Dynamics	Developed		Developed			Developed		
MECH4770 Fundamentals and Design of Electrochemical Energy Storage Systems	Proficient	Proficient	Proficient	Proficient	Proficient		Proficient	
MECH4880 Refrigeration and Air Conditioning 1	Proficient	Proficient	Proficient	Proficient			Proficient	
MECH4900 Mechanics of Fracture and Fatigue		Developed	Developed	Proficient				
MMAN4250 Micro/Nanofabrication and Technology	Proficient	Developed	Proficient	Proficient			Developed	
MMAN4400 Engineering Management	Developed	Developed	Developed	Developed	Proficient	Proficient	Developed	
MMAN4410 Finite Element Methods	Proficient		Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
Level 5 Electives								
AERO9500 Space Systems Architectures and Orbits	Proficient		Developed	Developed				Introduced

AERO9610 The Space Segment	Proficient			Proficient	Proficient	Proficient		
AERO9660 Advanced Aerospace Propulsion	Proficient		Proficient	Proficient			Developed	
ENGG9741 Introduction to Nuclear Engineering	Proficient	Proficient	Developed	Proficient	Developed		Proficient	Developed
MANF9543 Computer Aided Design / Computer Aided Manufacture	Proficient		Proficient	Proficient	Developed			
MECH9325 Fundamentals of Acoustics and Noise	Proficient	Proficient	Proficient	Proficient			Proficient	Developed
MECH9420 Composite Materials and Mechanics	Proficient	Proficient	Proficient	Proficient		Proficient	Proficient	Proficient
MECH9650 Applied Bio and Microfluidics	Proficient		Proficient	Proficient	Developed	Developed	Proficient	Proficient
MECH9720 Solar Thermal Energy Design	Proficient	Developed	Proficient	Proficient				Developed
MECH9761 Automobile Engine Technology	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
MMAN9350 Digital and Artificial Intelligence Technologies for Engineering Applications	Developed		Proficient	Proficient			Developed	Developed
Engineering & Technical Management Electives								
GSOE9340 Life Cycle Engineering	Developed	Developed	Proficient	Proficient	Proficient	Developed	Proficient	Developed
GSOE9810 Process and Product Quality in Engineering	Developed	Proficient	Proficient	Developed	Proficient	Developed		Developed
GSOE9820 Engineering Project Management			Developed	Developed	Proficient	Proficient	Developed	Developed
GSOE9830 Economic Decision Analysis in Engineering	Developed		Proficient	Developed	Proficient	Developed	Proficient	
MANF6860 Strategic Manufacturing Management	Introduced	Introduced			Introduced	Introduced	Introduced	Introduced
MANF9400 Industrial Management							Introduced	Introduced
MANF9472 Production Planning and Control					Introduced	Introduced	Introduced	Introduced
Research Core Courses								
MMAN9451 Masters Project A	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
MMAN9452 Masters Project B	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
MMAN9453 Masters Project C	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient

7. Assessments

Assessment Approach and Integrity

The School adopts a comprehensive approach to assessment that supports reflective practice, critical evaluation, self- and peer-assessment, responsible use of generative AI, and robust academic integrity. Assessment tasks are intentionally aligned with course learning outcomes and mapped to program-level graduate capabilities, ensuring that each task contributes meaningfully to verifying students' knowledge, skills, and professional competencies.

Breadth and Balance of Assessment Types

While historical analysis showed a strong reliance on examinations, assignments, and reports, the School is expanding assessment diversity to represent contemporary engineering practice better and reduce opportunities for misconduct. New assessment formats include:

- Reflective journals and reflective components within major assignments
- Peer- and self-assessment processes in team-based and design tasks
- Viva voce assessments to authenticate individual understanding
- Open-ended engineering design and investigation tasks
- Individualised portfolios and project-based submissions

Group work is limited to no more than 30% of a course's total assessment to ensure individual capability remains the dominant component.

The School has implemented many processes to ensure that academic integrity is maintained:

- All exam papers are reviewed by another academic, along with worked solutions.
- Online exams use as much randomisation as practically possible for the question type (question banks, numerical input randomisation and in some cases multiple parallel versions of questions with slightly different solution paths). Post-COVID online assessments are generally discouraged throughout all courses in the school to guarantee academic integrity.
- For many exam-style assessments, pen and paper answers are uploaded to Moodle via an ExamScan process managed by faculty. This improves marking procedures, especially when done at scale in large courses.
- In-person lab activities have been centre stage in our program and have been increased substantially as our programs have moved back to in-person face-to-face delivery modes.
- Academics are encouraged to include open-ended elements in all their examination questions, with students answering short essay-style questions. This enables the marker to check the alignment between simple answers and comprehension.
- Reports are submitted using TurnItIn, which ensures that students are not plagiarising or colluding, but does not deter some forms of contract cheating.
- Model report/assignment rubrics have been provided to reward open-ended and creative solutions by students to discourage collusion and contract cheating. These have shown some initial promise, but much more evaluation and testing are required.

- Important works, such as thesis, have two (or three) markers to ensure consistency.
- Some courses have taken on viva-style assessments for all students, but these have proved challenging at scale without centralised support for scheduling.

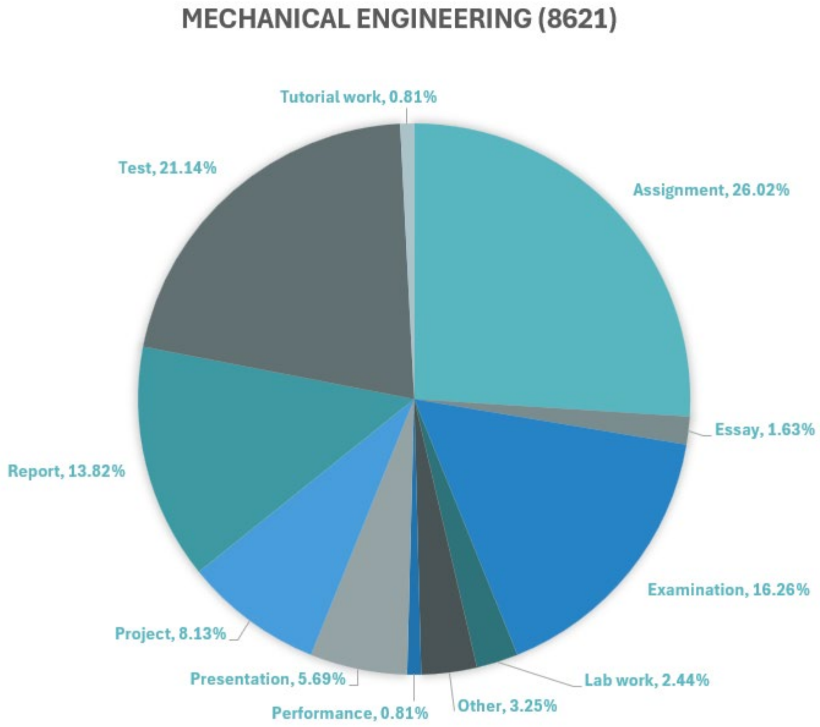

Figure 1. Percentage of assessment types used within the specialisation.

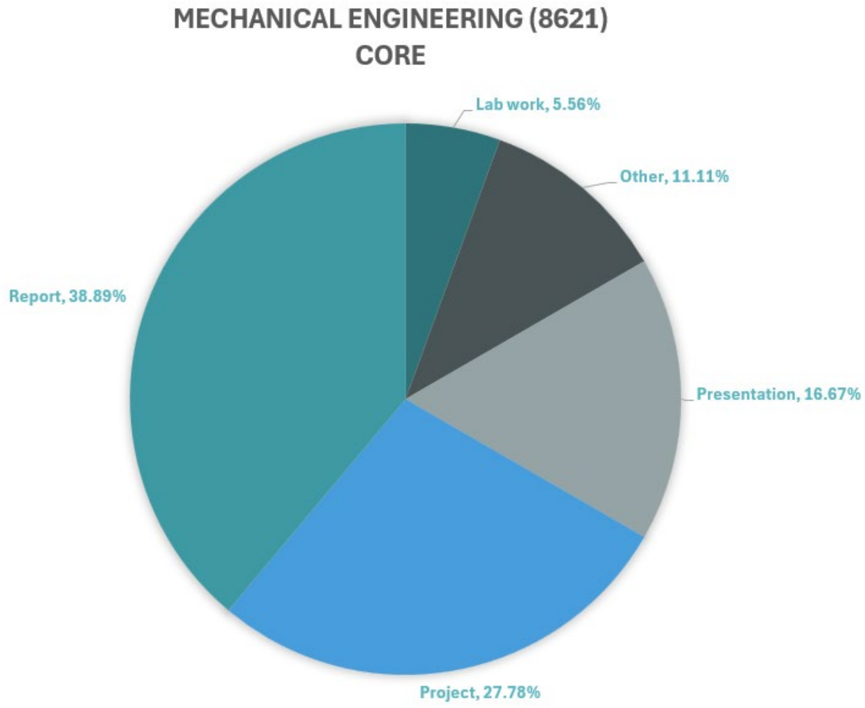

Figure 2. Percentage of assessment types used within the core of the specialisation.

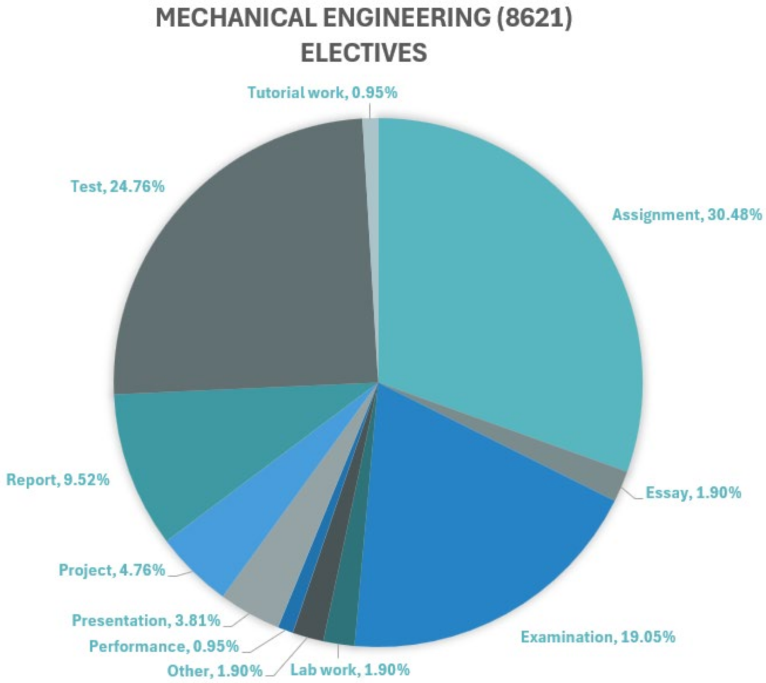

Figure 3. Percentage of assessment types used within the electives of the specialisation.

8. Specialisation Progression Plan

The program embeds multiple mechanisms to facilitate student reflection, self-assessment, and ongoing tracking of graduate capability development over time. Central to this support is the structured *progression plan*, which provides students with a clear visual roadmap of their academic journey and enables them to reflect on their development as they progress through the program. Key mechanisms include:

Structured Progression Plans as Reflection Tools

- The progression plans clearly outline when students undertake core courses, Level 4 elective courses, Level 5 elective courses, Engineering Technical Management (ETM) electives, and the research thesis.
- By mapping learning components across Terms 1 to 3, students can track the timing, purpose, and cumulative development of their graduate capabilities.
- The separation of course types (core, level 4, level 5 electives and thesis) help students reflect on how their skills build over time, from introductory concepts through to advanced application and independent research.

Guided Academic Advising and Course Selection Support

- Students are encouraged to use the progression plans when meeting with academic advisors or program authorities.

- These conversations help students assess whether they are on track with capability development (e.g., problem-solving, teamwork, research, design, and communication skills) and make informed decisions about electives aligned with their career goals.

Capstone Thesis as a Culminating Reflection Point

- The thesis sequence (MMAN9451, MMAN9452, MMAN9453) requires students to evaluate their skills in research, project planning, communication, and technical problem-solving.
- Supervisory meetings often include reflective check-ins, prompting students to consider their progress toward achieving graduate capabilities.

Optional Enrichment Pathways for Self-Directed Development

- Opportunities such as the Vertically Integrated Project (VIP) allow postgraduate students to reflect on their broader professional skills: teamwork, communication, and interdisciplinary collaboration, and benchmark themselves against peers from other engineering disciplines.

Workshops and Program Induction Activities

- During orientation and term-start Welcome Workshops, students receive guidance on using progression plans to monitor their development.
- These sessions also reinforce reflective learning practices, encouraging students to review their progress at key points in the term.

Degree Structure

Accumulative Unit of Credit (UoC)																Industry Training
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
6 UoC Core	36 UoC Level 4 Electives						30 UoC Level 5 Electives					12 UoC ETM		12 UoC Thesis		60 days

Table 1. Study plan for the ME (Mechanical Engineering)

Year	Term	Course Code & Name
Year 1	**T1**	Level 4 Electives (6UOC)
		Level 4 Electives (6UOC)
		Engineering & Technical Management Electives (6UOC)
	T2	Level 4 Electives (6UOC)
		Level 4 Electives (6UOC)
		MECH4100 Mechanical Design 2 (6UOC)
	T3	Level 4 Electives (6UOC)
		Level 4 Electives (6UOC)
Year 2	**T1**	Level 5 Electives (6UOC)
		MMAN9451 Masters Project A (4UOC)
		Engineering & Technical Management Electives (6UOC)

	T2	Level 5 Electives (6UOC)
		Level 5 Electives (6UOC)
		MMAN9452 Masters Project B (4UOC)
	T3	Level 5 Electives (6UOC)
		Level 5 Electives (6UOC)
		ENGG4999 Industrial Training (0UOC)

Students can track their progression through the “myPlan” checker tool.
myPlan | Current Students - UNSW Sydney
A progression checklist and/or study plan is also available for students for the single degree and the double degree offerings.
Progression checksheets & study plans | Engineering - UNSW Sydney