UNSW SYDNEY

UNSW Engineering

Education Specification

1. Program Overview

Program Title: Bachelor of Engineering (Honours)

Award Title: Bachelor of Engineering (Honours) (Quantum Engineering)

Engineering Discipline: Quantum Engineering

The Bachelor of Engineering (Honours) in Quantum Engineering (Program Code: 3707, Plan Code: ELECCH3707) is a four-year full-time program requiring the completion of 192 Units of Credit (UoC). It is designed to equip students with a strong foundation in mathematics, physics, computing, and engineering design, followed by advanced studies in quantum devices and technologies. Its structure ensures that graduates develop both technical expertise and professional skills required for contemporary and future engineering practice.

The program is explicitly mapped to the Engineers Australia Stage 1 Competency Standard, ensuring graduates demonstrate:

- *Knowledge and Skill Base*: Mastery of electrical engineering principles, including electronics, communications, signal processing, and control, and more specifically, quantum engineering principles such as quantum mechanics, quantum electronics, quantum computing, quantum communication, and nanofabrication.
- *Engineering Application Ability*: Capacity to apply theory to practice through laboratory work, design projects, and a capstone thesis.
- *Professional and Personal Attributes*: Development of ethical awareness, teamwork, leadership, communication, and lifelong learning skills through embedded professional practice courses and general education requirements.

In terms of the rationale for program title and discipline focus, the title *Bachelor of Engineering (Honours) (Quantum Engineering)* reflects both the academic depth and professional orientation of the program:

- *Bachelor of Engineering (Honours)* indicates a four-year program with a significant research and design component, culminating in a thesis.
- *Quantum Engineering* specifies the discipline focus, highlighting the program's emphasis on the design, implementation, and application of quantum technologies, including quantum computing, quantum communication networks, quantum sensing and quantum control .

2. Career Alignment

ELECCH3707 is designed to produce graduates who are professionally prepared for emerging and rapidly expanding sectors built on quantum technologies. The curriculum integrates foundational engineering principles with advanced quantum science, quantum devices, and quantum-enabled systems including computers, communications and sensing systems. This equips graduates with the technical, analytical, and professional competencies required to contribute to Australia's priority industries and global technology developments.

2.1. Alignment with Industry Sectors and Workforce Needs

ELECCH3707 equips students with knowledge and skills relevant to quantum-technology sectors in Australia and internationally, including:

- Quantum Computing and Quantum Information Technology: Graduates gain competencies in quantum algorithms, qubit architectures, cryogenic systems, and quantum software tools. These capabilities prepare students for roles in quantum-hardware development, quantum-software engineering, and systems-level integration in organisations such as national laboratories, quantum start-ups, high-performance computing centres, and global technology firms.
- Quantum Communications and Cybersecurity: The curriculum covers quantum key distribution, secure optical communication systems, quantum random-number generation, and satellite-based quantum links. Graduates are prepared for roles in secure communication infrastructure development and national cybersecurity programs, consistent with emerging industry demand for post-quantum-secure technologies.
- Quantum Sensing, Metrology, and Precision Measurement: The curriculum includes study of atomic clocks, magnetometers, interferometry, and quantum-enhanced sensing. This prepares graduates for careers in defence technologies, geospatial intelligence, precision navigation, medical imaging, mineral exploration, and environmental monitoring — sectors increasingly adopting quantum-enhanced instruments.
- Semiconductor, Photonics, and Advanced Materials Industries: Students receive training in quantum materials, nanofabrication techniques, photonics, and device engineering. This supports workforce needs across semiconductor manufacturing, cryogenic electronics, and specialised fabrication facilities.
- Systems Engineering, Integration, and Emerging Quantum-Enabled Industries: As quantum systems transition from research to engineered products, graduates are prepared to work in hybrid classical–quantum systems, control electronics, high-frequency (microwave and RF) hardware, and cryogenic engineering. Roles include system integrator, test and validation engineer, electronics design engineer, and applied research engineer.

2.2. Preparation for Professional Engineering Practice

ELECCH3707 structure ensures students progressively develop the capabilities expected of an entry-level professional engineer, through:

- Strong Foundations in Engineering Theory and Application: Students develop proficiency in electromagnetics, electronics, computer engineering, signal processing, control systems, materials science, and software development. These underpin both conventional engineering roles and specialised quantum-technology positions.
- Specialised Quantum Engineering Knowledge and Skills: Vertical integration of quantum theory, quantum device physics, quantum hardware laboratories, quantum-software tools and quantum programming languages ensure graduates can contribute to multidisciplinary quantum-technology programs. Laboratory experiences include hands-on work with optical systems, spin-based systems and rudimentary quantum processors based on superconducting circuits.
- Practical Design, Experimentation, and Systems Integration Experience: Students undertake design studios, team-based design thesis projects, and capstone experiences that simulate industry environments. Activities include designing quantum protocols, integrating measurement hardware, and developing cryogenic control systems. These experiences prepare students for R&D, prototyping, and product-development roles.
- Professional Skills for a Technology-Driven Workforce: Communication skills, ethical practice, safety culture, systems thinking, and interdisciplinary collaboration are developed throughout the

program. Given the cross-disciplinary nature of quantum technologies, graduates are well prepared for teamwork involving physicists, computer scientists, materials engineers, and industry specialists.

- Adaptability for Rapidly Evolving Emerging Industries: ELECCH3707 develops graduates who can interpret new research, adapt to evolving hardware platforms, and engage with ongoing technological change. This professional flexibility is critical for industries where technological maturity is still developing and engineering standards are emerging.

2.3. Typical Career Pathways

ELECCH3707 graduates are prepared for roles such as:

- Quantum hardware engineer.
- Quantum software or algorithm engineer.
- Quantum communications engineer.
- Systems engineer for hybrid classical–quantum technologies.
- Semiconductor device engineer.
- Cryogenic systems engineer.
- Microwave / RF quantum engineer.
- Quantum-sensing instrumentation engineer.
- Quantum research engineer in national labs, research institutions, or defence organisations.
- Data scientist or computational engineer with quantum-enhanced toolsets.

3. Specialisation Framework

The Specialisation Learning Outcomes (SLOs) were developed through rigorous internal consultations (School and Engineering Faculty). In the first stage at the school level, working groups were formed with members of academic teaching staff from various disciplinary areas to formulate the SLOs. The SLOs were reviewed by the School's Academic Executive Committee (AEC). External consultations were then sought from the School's Industry Advisory Board (IAB) for their advice and feedback, particularly the expectation of industry with regards to graduate capabilities. The Engineering Faculty Education Committee (FEC) reviewed and approved the SLOs before the final approval by the Faculty Board. The developed SLOs were shared and discussed with all teaching staff in the school through a School Board meeting. This consultative process ensured that the SLOs were not only academically rigorous but also aligned with industry expectations and Engineers Australia Stage 1 Competency Standards.

On successful completion of this specialisation, graduates will be able to:

SLO1. Show proficiency of knowledge in the fundamental enabling sciences of quantum mechanics, mathematics, computer science and electromagnetics that underpins Quantum Engineering, and relate the physical laws of quantum mechanics to the fundamental principles of engineering.

SLO2. Identify, select and proficiently apply specialist technical knowledge and mathematical and computational tools to analyse engineered quantum and electrical systems and networks.

SLO3. Critically evaluate quantum and electrical devices and systems to solve complex open-ended problems and recognize their relevance to the future development of the discipline.

SLO4. Demonstrate a broad understanding of design and operation principles for engineered quantum systems and networks, and articulate future directions for the development of enhanced quantum devices and their application to problems of practical relevance in the fields of computing, communications, and sensing.

SLO5. Design, assemble and utilise classical electrical engineering devices, for example electronic and microwave devices and computational tools, needed to interface with and operate quantum systems.

SLO6. Lead and manage quantum engineering projects, individually or as part of an interdisciplinary team, in a systematic and professional manner.

SLO7. Synthesize engineering practices with norms and regulations of relevance to the safe and ethical application of engineered quantum systems.

SLO8. Demonstrate proficiency in the effective communication of systematic engineering synthesis, design processes, critical evaluation, and implications of results to all audiences, in particular as they apply to quantum engineered systems.

The knowledge base developed in SLO1 directly supports the Stage 1 competency requirement for a sound and comprehensive grasp of underpinning engineering sciences. SLO2 ensures graduates can apply advanced technical knowledge to practical engineering problems, meeting the competency in engineering application ability. The analytical and problem-solving skills in SLO3 reflect professional trends towards innovation and adaptability in modern engineering practice. SLO4 demonstrates attainment of competencies in creativity, design innovation, and the ability to manage complex projects. The professional attitude and ethical responsibility highlighted in SLO5 align with industry and community needs for socially responsible engineers committed to sustainable practice. Finally, SLO6—SLO8 ensure graduates meet the competencies in professional and personal attributes, becoming effective communicators and collaborators in multidisciplinary environments, particularly in the rapidly evolving global quantum technology sector.

4. Continuous Improvement

The School of Electrical Engineering and Telecommunications (EE&T) has embedded a culture of continuous improvement into the design and delivery of the Quantum Engineering specialisation. Program quality is assured through systematic evaluation of teaching practices, assessment integrity, industry feedback, and alignment with Engineers Australia (EA) Stage 1 Competency Standards.

Academic integrity is safeguarded through robust assessment processes, which are explained in detail in Section 7. To ensure academic integrity, all final exam papers are reviewed by another academic with relevant technical knowledge and then a final review of the papers is done by the Director of Academic Studies. Thesis reports are submitted using Turnitin for checking against plagiarism, and they are blind marked by two academics to ensure consistency. A third assessor is utilised if there is a discrepancy larger than ten marks. For online written exams, various approaches have been adopted such as personalised exam papers or having a number of different versions. Some courses include an oral assessment as a compulsory component to pass the course. The markers are trained to identify plagiarism in the exams/reports and if anything identified, these are referred to the School Student Integrity Advisor, who meets with students before finalising an outcome. Plagiarism cases found are recorded in the university Plagiarism Register or Misconduct Register, the latter for serious cases. These measures demonstrate the School's commitment to continuous quality assurance and integrity in assessment practices, ensuring alignment with professional standards and community expectations.

Curriculum evaluation extends beyond coursework to include industrial engagement. The 60-day Industrial Training amounts to 480 hours in total as compared to the standard study load of 150 hours for a course. Thus, it is equivalent to 3 courses targeting mainly on EA's competencies 2 and 3, resulting in a more balanced overall curriculum alignment. The heatmap (Fig. 4) provides a high-level, strategic view of the specialisation that will inform all future course and specialisation revisions. This systematic evaluation process ensures that program design remains responsive to industry needs, accreditation requirements, and future workforce demand. Practical learning remains a cornerstone of the program. Laboratory work, which takes place every week in every technical course, accounts for a significant proportion of contact hours, ensuring students gain hands-on experience with quantum technologies and quantum simulation software platforms.

Continuous improvement is also driven by industry and community needs. Feedback from the Industry Advisory Board informs curriculum updates, ensuring graduates are prepared for evolving demands in areas such as quantum computing, secure quantum communications, quantum sensing, and advanced materials. The specialisation is strongly integrated with UNSW's internationally recognised ARC Centre for Quantum Computation and Communication Technology and will continue this integration with the newly awarded $35M ARC Centre for Quantum Computer Performance and Integration led by Scientia Professor Andrea Morello, providing students with direct exposure to world-leading research. It is also closely aligned with the Sydney Quantum Academy, enabling students in UNSW to participate in cross-institutional coursework, industry engagement, mentoring, and research training activities across the Sydney quantum ecosystem. In addition, UNSW maintains partnerships with global quantum industry leaders such as Diraq - a quantum computing company founded and led by academic staff within the School - as well as Silicon Quantum Computing, Q-CTRL, IBM, Google, and Microsoft, ensuring that students engage with cutting-edge developments and industry expectations. The program is regularly benchmarked against international standards and professional trends, ensuring that graduates remain competitive in global engineering markets.

Through these mechanisms, the Quantum Engineering specialisation maintains a dynamic and responsive curriculum. Ongoing evaluation of assessment integrity, industry engagement, and technological innovation ensures that graduates are not only aligned with Engineers Australia Stage 1 competencies but also prepared to meet the challenges of future quantum engineering practice.

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

Curriculum mapping for the Quantum Engineering specialisation (ELECCH3707) of the 3707 Bachelor of Engineering (Honours) program started at the course level and progressed to the specialisation level. At the course level, course coordinators develop course outlines (COs) to articulate the course's context and relevance within the program. Each CO includes details about the course learning outcomes (CLOs) which lists the knowledge, attributes, skills, and practices that students are expected to acquire and demonstrate after completing that course. Each CO also specifies the various assessments (exam, quiz, lab, assignment, etc) and their alignment to validate attainment of the CLOs. UNSW Assessment Policy prescribes that each course can have up to four main assessment components of varying weightings, and each component may comprise several subcomponents. The assessment weightings and the mapping of assessments to CLOs are developed by course coordinators and provided in the COs for transparency in the course design and assessment. UNSW Enterprise Course Outline System is used for generating the COs so that CLOs, assessments, and other key course information can be easily located, linked to the educational platform (e.g. MOODLE). This ensures a consistent format across all courses.

At the specialisation level, the curriculum mapping was conducted in two stages.

Stage 1: An Excel-based mapping tool—developed specifically for mapping the CLOs of all core and elective courses in the ELECCH specialisation to the eight SLOs—was used. This tool allows each CLO in a course to be mapped to the SLOs with either introduced, developed, or proficient attainment levels. The CLO-SLO mappings for the courses were completed by the course convenors. The mappings were subsequently reviewed by the School educational team consisting of Deputy Head of School Education, Director of UG Academic studies, Director of PG Academic studies, and Deputy Director of PG Academic Studies. Fig. 2 shows screenshot of the completed CLO–SLO mapping for some example courses.

Table 1. SLO-PLO mapping

SLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16
1. Show proficiency of knowledge in the fundamental enabling sciences of quantum mechanics, mathematics, computer science and electromagnetics that underpins Quantum Engineering, and relate the physical laws of quantum mechanics to the fundamental principles of engineering.	x	x	x													
2. Identify, select and proficiently apply specialist technical knowledge and mathematical and computational tools to analyse engineered quantum and electrical systems and networks.		x	x		x		x	x	x							
3. Critically evaluate quantum and electrical devices and systems to solve complex open-ended problems and recognize their relevance to the future development of the discipline.				x	x		x		x							
4. Demonstrate a broad understanding of design and operation principles for engineered quantum systems and networks, and articulate future directions for the development of enhanced quantum devices and their application to problems of practical relevance in the fields of computing, communications, and sensing.				x	x	x	x	x	x	x						
5. Design, assemble and utilise classical electrical engineering devices, for example electronic and microwave devices and computational tools, needed to interface with and operate quantum systems.							x	x	x							
6. Lead and manage quantum engineering projects, individually or as part of an interdisciplinary team, in a systematic and professional manner.										x	x			x	x	x
7. Synthesize engineering practices with norms and regulations of relevance to the safe and ethical application of engineered quantum systems.						x					x					
8. Demonstrate proficiency in the effective communication of systematic engineering synthesis, design processes, critical evaluation, and implications of results to all audiences, in particular as they apply to quantum engineered systems.												x	x	x	x	x

NOTE: [PLO1]Comprehensive theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering; [PLO2] Conceptual understanding of the mathematics, numerical analysis, statistics and computer and information sciences which underpin the engineering discipline: [PLO3] In-depth understanding of specialist bodies of knowledge within the engineering discipline; [PLO4] Discernment of knowledge development and research directions within the engineering discipline; [PLO5] Knowledge of engineering design practice and contextual factors impacting the engineering discipline; [PLO6] Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice; [PLO7]Application of established engineering methods to complex engineering problem solving; [PLO8]Fluent application of engineering techniques, tools and resources; [PLO9]Application of systematic engineering synthesis and design processes; [PLO10] Application of systematic approaches to the conduct and management of engineering projects; [PLO11] Ethical conduct and professional accountability; [PLO12] Effective oral and written communication in professional and lay domains; [PLO13] Creative, innovative and pro-active demeanour; [PLO14] Professional use and management of information; [PL15] Orderly management of self and professional conduct; [PL16] Effective team membership and team leadership.

Table 2. Completed CLO-SLO mapping.

Course code	1. Show proficiency of knowledge in the fundamental enabling sciences of quantum mechanics, mathematics, computer science and electromagnetics that underpins Quantum Engineering, and relate the physical laws of quantum mechanics to the fundamental principle	2. Identify, select and proficiently apply specialist technical knowledge and mathematical and computational tools to analyse engineered quantum and electrical systems and networks.	3. Critically evaluate quantum and electrical devices and systems to solve complex open-ended problems and recognize their relevance to the future development of the discipline.	4. Demonstrate a broad understanding of design and operation principles for engineered quantum systems and networks, and articulate future directions for the development of enhanced quantum devices and their application to problems of practical relevance	5. Design, assemble and utilise classical electrical engineering devices, for example electronic and microwave devices and computational tools, needed to interface with and operate quantum systems.	6. Lead and manage quantum engineering projects, individually or as part of an interdisciplinary team, in a systematic and professional manner.	7. Synthesize engineering practices with norms and regulations of relevance to the safe and ethical application of engineered quantum systems.	8. Demonstrate proficiency in the effective communication of systematic engineering synthesis, design processes, critical evaluation, and implications of results to all audiences, in particular as they apply to quantum engineered systems.
Level 1 Core Courses								
COMP1511	Introduced							
DESN1000	Introduced	Introduced	Developed		Developed	Introduced		Developed
ELEC1111	Introduced	Introduced	Introduced		Introduced	Introduced	Introduced	Introduced
MATH1131	Developed		Introduced					Introduced
MATH1141	Developed		Introduced					Introduced
MATH1231	Developed		Introduced					Introduced
MATH1241	Developed		Introduced					Introduced
PHYS1121	Introduced							
PHYS1131	Introduced							
PHYS1231	Introduced							
Level 2 Core Courses								
DESN2000	Developed	Developed	Introduced		Introduced	Introduced	Introduced	Developed
ELEC2133	Developed	Developed	Introduced		Introduced			
ELEC2134	Developed	Developed	Introduced		Introduced			
ELEC2141	Developed	Developed						
MATH2069	Developed							
MATH2099	Developed							
Level 3 Core Courses								
ELEC3104	Developed	Developed	Developed		Introduced			Proficient
ELEC3106	Developed	Introduced	Introduced		Developed			Introduced
ELEC3114	Developed	Developed	Introduced		Introduced			
ELEC3115	Developed	Developed	Introduced		Introduced	Introduced	Introduced	Introduced
ELEC3117	Developed		Proficient		Developed	Proficient	Proficient	Proficient
ELEC3705	Proficient	Proficient	Proficient	Proficient	Introduced			
PHYS3118	Proficient	Proficient	Developed	Developed		Developed	Developed	Developed

Level 4 Core Courses								
ELEC4122						Proficient	Proficient	Proficient
ELEC4123	Developed	Developed	Developed	Introduced	Developed	Proficient	Developed	Developed
ELEC4605	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient		Developed
ELEC4951		Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ELEC4952		Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ELEC4953		Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
TELE9757	Proficient	Proficient	Proficient	Developed	Developed			Proficient
Breadth Electives								
COMP2041	Developed							Developed
COMP3211	Proficient		Developed					Developed
COMP3231	Proficient							
ELEC3145		Introduced	Developed		Developed			Introduced
ELEC4445						Proficient		Developed
ELEC4601	Proficient	Proficient	Proficient		Developed			Developed
ELEC4602	Developed	Developed	Developed		Developed			Developed
ELEC4603	Proficient	Proficient	Proficient	Proficient	Developed	Developed	Introduced	Developed
ELEC4621	Proficient	Proficient	Proficient					
ELEC4622	Proficient	Proficient	Developed		Developed			Introduced
ELEC4623	Proficient	Proficient	Proficient		Proficient	Developed	Developed	
ELEC4631	Proficient	Developed	Developed		Developed			Developed
ELEC4632	Proficient	Developed	Developed		Developed	Introduced	Introduced	Introduced
ENGG2600		Introduced	Introduced		Introduced	Introduced	Introduced	Introduced
ENGG3001	Introduced	Introduced	Introduced				Developed	Developed
ENGG3600		Developed	Developed		Developed	Developed		Developed
ENGG4600		Proficient	Proficient		Proficient	Proficient		Proficient
MATH3101	Proficient							
MATH3121	Proficient							
MATH3161	Proficient		Developed					Developed
MATH3201	Proficient							
MATH3411	Developed							
PHTN4661		Developed	Developed	Developed				
PHTN4662	Developed	Developed	Developed		Introduced			Developed
TELE3113	Developed	Developed	Introduced		Introduced			Introduced
TELE3118	Proficient	Developed	Proficient		Proficient	Developed	Developed	Developed
TELE4642	Proficient	Proficient	Proficient		Proficient	Developed	Developed	Developed
TELE4651	Developed	Proficient	Developed		Developed	Developed	Developed	Proficient
TELE4652	Developed	Proficient	Proficient		Proficient	Developed	Developed	Developed
TELE4653	Proficient	Proficient	Developed		Developed	Developed	Developed	Proficient

7. Assessments

7.1. Assessment types used within the specialisation

The mixture of assessment types used within the specialisation is shown below in Figs. 1-3.

As is typical of many specialisations, early courses are content-driven and the assessments reflect a desire to see demonstration of individual learning in tests or examinations. Students commonly have opportunities for longer-form formative or summative assignment activities. In later years, the assessment mix tends to pivot towards project work, often in teams.

It is noted in many courses, terms such as assignment, essay, report, and project are often used interchangeably. Similarly, exam and test, as well as presentation and performance, may refer to comparable forms of assessment. For example, a presentation based on a project might be categorized either as a project or as a presentation. Laboratory work may also be evaluated through reports, interviews, or presentations, and therefore may not always be explicitly labelled as “Laboratory”.

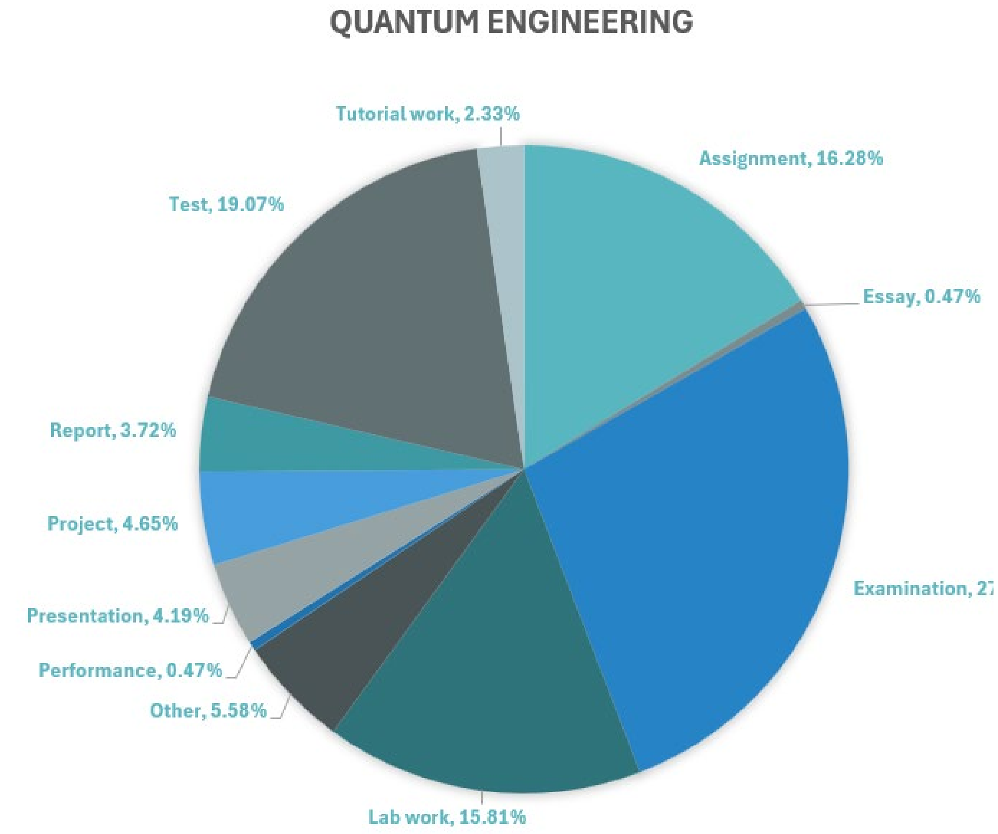

Fig. 1: Percentage of assessment types used within the specialisation.

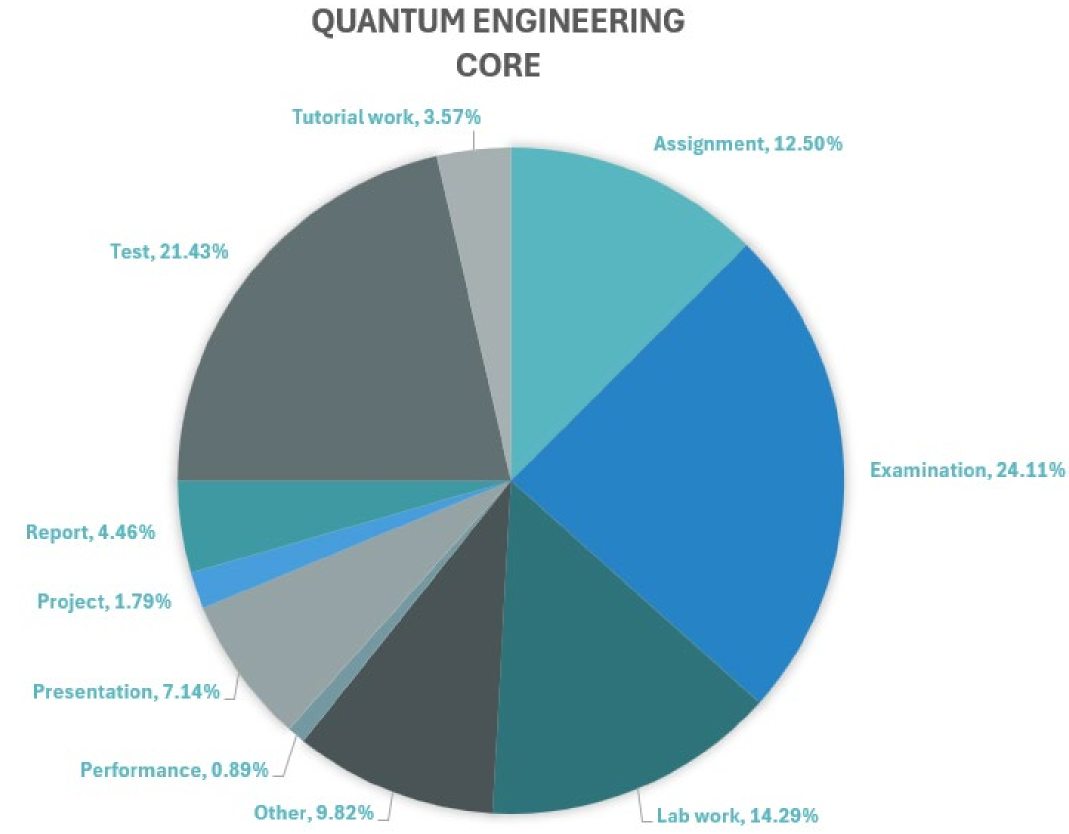

Fig. 2: Percentage of assessment types used within the core of the specialisation.

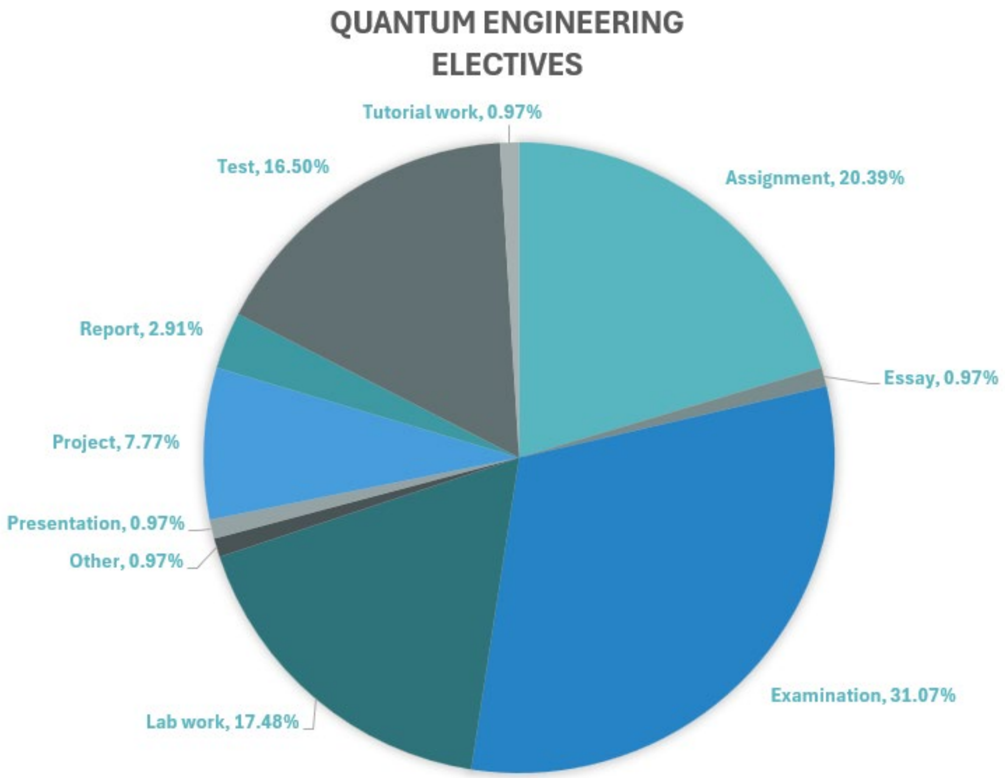

Fig. 3: Percentage of assessment types used within the electives of the specialisation.

7.2. Alignment of assessment and grading with learning outcomes and graduate capabilities

The School of EE&T employs a comprehensive and integrated assessment strategy to ensure that students achieve the intended learning outcomes at the course level and demonstrate the graduate capabilities required by Engineers Australia. This strategy is underpinned by deliberate alignment between course-level learning outcomes (CLOs), assessment tasks, and program-level learning outcomes (PLOs), ensuring a coherent and cumulative learning experience across the program.

Assessment tasks within each course are designed to directly target specific CLOs. These tasks span a diverse range of formats—including laboratory work, design projects, programming assignments, oral presentations, quizzes, and examinations—to capture the breadth of skills and knowledge expected of engineering graduates. The variety ensures that students are assessed not only on their theoretical understanding but also on their ability to apply concepts in practical, real-world contexts.

In order to ensure the alignment between CLOs and assessment, every course outline includes an explicit mapping of CLOs to assessment tasks. This mapping ensures that all CLOs are assessed through one or more appropriately designed tasks, providing multiple opportunities for students to demonstrate their competence. This alignment is documented and made transparent to students, reinforcing the purpose of each assessment and how it contributes to their overall development. It also enables academic staff to systematically monitor and ensure comprehensive coverage of learning outcomes across the curriculum.

To support consistency and fairness in evaluation, each assessment task is accompanied by a detailed grading schema or rubric. These rubrics articulate clear performance criteria aligned with UNSW's academic standards and/or Engineers Australia's Stage 1 Competency Standards. Students are provided with these rubrics in advance, promoting transparency and helping them understand the expectations for success. Moderation processes—including peer review of assessment instruments, calibration of marking, and analysis of grade distributions—are routinely implemented to ensure reliability and equity across different offerings and delivery modes.

Graduate capability validation is achieved through the aggregation of assessment data across the program. Capstone design projects and industry placements serve as critical points where students demonstrate the synthesis of knowledge, problem-solving, communication, teamwork, and ethical practice. These experiences are mapped to program-level learning outcomes, which in turn align with Engineers Australia's graduate attributes. Evidence of student attainment is collected through embedded assessments and reflective activities and is reviewed as part of the School's ongoing quality assurance and curriculum review processes.

This continuous improvement framework is supported by regular stakeholder engagement—including feedback from students, industry partners, and alumni—as well as benchmarking against national and international standards. These inputs inform the refinement of assessment strategies, ensuring that they remain aligned with evolving professional expectations and continue to support the development of capable, work-ready graduates.

7.3. Reflective practice and standards-based self-assessment

In terms of reflective practice and self-assessment processes, these are embedded throughout the program to support students in tracking their progressive attainment of graduate capabilities. These processes are explicitly referenced to relevant standards and benchmarks, including Engineers Australia's Stage 1 Competency Standards and UNSW's program-level learning outcomes, ensuring that students develop a clear understanding of their growth and readiness for professional practice.

Reflective activities are integrated into multiple courses across the program, particularly in design projects and laboratory work. Students are encouraged to critically evaluate their own performance, identify areas for improvement, and articulate how their learning aligns with the expected graduate capabilities. These reflections often take the form of structured journals, post-assessment reviews, peer evaluations, and guided prompts that link personal development to specific learning outcomes.

Self-assessment is further supported by rubrics and capability frameworks that are shared with students at the beginning of each course. These tools allow students to benchmark their progress against defined performance criteria and graduate attributes. In some courses, students complete self-marking exercises at key milestones, comparing their perceived competence with instructor feedback – this is the case for the self-marking task performed for the mid-term examination in the early year courses ELEC1111 – Electrical Circuit Fundamentals and ELEC2134 – Circuits and Signals. This triangulated approach fosters metacognitive awareness and empowers students to take ownership of their learning journey.

Capstone courses and industry-linked experiences provide additional opportunities for reflective practice. Students are required to submit reflective reports that explicitly address how their project work demonstrates attainment of Engineers Australia's competencies, including problem-solving, communication, teamwork, and ethical responsibility. These reflections are assessed not only for content but also for the student's ability to critically engage with professional standards and articulate their readiness for graduate practice.

These reflective and self-assessment practices are reviewed regularly as part of the School's quality assurance processes. Feedback from students, academic staff, and industry stakeholders informs the continuous enhancement of these mechanisms to ensure they remain meaningful, standards-aligned, and effective in preparing students for professional engineering roles.

7.4. Approaches to the use of generative AI and assessment integrity

The program recognises the growing influence of generative AI tools in engineering education and practice. Assessment tasks are structured to minimise risks of academic misconduct while encouraging authentic engagement. Strategies include:

- Emphasis on problem solving, design justification, and reflective commentary that require individual reasoning beyond AI outputs.
- Use of oral presentations, in class demonstrations, and iterative submissions to verify student ownership of work.
- Clear marking rubrics that reward critical review of AI-assisted content rather than passive reproduction.

By embedding reflection on AI use within assessment, students develop awareness of ethical responsibilities, intellectual property considerations, and professional accountability. This approach also ensures that while students gain familiarity with emerging technologies, assessment integrity is preserved, and graduate capabilities in critical thinking, reflective practice, and ethical judgment are strengthened.

Some specific examples of how students are instructed to use generative AI are as follows: In some courses, such as ELEC3705 – Fundamentals of Quantum Engineering, generative AI may be used for writing and debugging code on the two take-home assignments, as per modern software development practices. Integrity is safeguarded through demonstrations that confirm student ownership of work. In other courses, such as ELEC4122 – Strategic Leadership and Ethics, AI can assist with background research or brainstorming, but students must critically reflect on its reliability and ethical implications. This ensures independent judgment and alignment with professional responsibility standards.

8. Specialisation Progression Plan

To contextualize the discussion of specialisation progression plan, it is important to first outline the structure of the ELECCH3707 specialisation. The following diagrams present both the single and dual degree pathways, followed by the recommended study plan. These visual representations highlight the sequencing of core courses, specialisation electives, and integrative learning experiences across the program. By establishing a clear view of the curriculum design, the progression plan can be better understood in relation to how students engage with learning outcomes, track their development, and build towards the attainment of graduate capabilities.

The programs offered by the School of EE&T are designed to progressively cultivate student autonomy, critical thinking, and lifelong learning skills. The curriculum scaffolds independent learning, reflective practice, peer and self-assessment across all stages of the program, ensuring students are well-prepared for professional engineering practice. Progression plans are embedded throughout the curriculum, providing students with clear developmental milestones and documented pathways that allow both staff and students to monitor capability growth from foundational knowledge to advanced professional practice.

Years 1–2: Building Foundations for Independent Learning

In the early years, students engage with structured learning environments that introduce core engineering principles while encouraging self-directed inquiry. For example, ELEC1111 – Electrical Circuit Fundamentals introduces students to reflective learning through structured feedback during laboratory evaluations and self-marking of the mid-term exam. This course begins the transition from guided instruction to independent exploration. Progression plans at this stage emphasise the acquisition of core knowledge and the initial development of reflective practice, enabling students to track their movement from guided learning to independent inquiry.

Years 2–3: Developing Critical Review and Reflective Practice

As students progress, the curriculum emphasises deeper engagement with complex engineering problems and critical evaluation. Examples of key courses include:

- ELEC2134 – Circuits and Signals, which fosters critical review and reflective practice by requiring students to analyse and compare circuit models, evaluate simulation results against theory, and reflect on laboratory outcomes to identify errors and improvements. Through iterative problem solving, feedback, and progressive learning, the course develops students' ability to critically assess their own work and learning trajectory.
- ELEC3104 – Digital Signal Processing is structured around the Tiered Learning Framework (TLF), a student-driven learning framework for course and assessment design. The TLT divides the learning curve within a course into five levels, encourages students to think about which level they are currently at with their learning, and guides them on what they need to do to progress to the next level. Within this proposed framework, students have more control and choice over how much they want to learn and deepen their knowledge. All elements of the course including problem sheets, assessments, labs, project and final exam are structured as per the tiered framework and students find a greater sense of connection and achievement in assessing their depth of study and choosing their learning level. As a result, they are better equipped to manage their time and have the satisfaction of achieving their self-set goals.
- ELEC3117 – Electrical Engineering Design provides a capstone experience that explicitly develops students' capacity for critical review and reflective practice. Through team-based design projects, students evaluate alternative technical solutions against performance, cost, safety, and sustainability criteria, while reflecting on their own contributions and professional responsibilities. Iterative design cycles, structured feedback, and engagement with industry standards require students to critically assess decisions and refine approaches, thereby strengthening judgment and self-assessment.

These experiences enhance students' ability to critically assess their own work and that of peers, while refining their technical judgment. Progression plans during this stage highlight the transition from foundational knowledge to advanced analytical and design capabilities, ensuring students can see and document their growth in problem-solving and reflective practice.

Year 4: Capstone and Professional Autonomy

The final year focuses on synthesizing technical knowledge with independent project execution. Examples of key courses include:

- ELEC4123 – Design Proficiency represents a pivotal capstone experience in the program, where students transition from structured coursework into independent, professionally oriented practice in the area of quantum engineering. The course requires students to integrate knowledge to deliver design projects on different disciplines, exercising autonomy in problem definition, solution development, and project management. By engaging with open-ended, industry relevant challenges, students critically evaluate technical options, reflect on their decision-making processes, and assume responsibility for outcomes. This progression into capstone work fosters professional judgment, self-assessment, and autonomy.
- ELEC4951/ELEC4952/ELEC4953– Thesis A/B/C require students to undertake substantial individual research or design projects. These include:
    - Independent planning and execution of engineering investigations.
    - Critical literature review and synthesis of current research.
    - Formal self-assessment and reflection on project outcomes.
    - Peer feedback during oral presentations and poster sessions.

- ELEC4122 – Strategic Leadership & Ethics, develops students' capacity for professional autonomy by engaging them with the ethical, managerial, and strategic dimensions of engineering practice. The course requires students to critically review case studies, reflect on leadership approaches, and evaluate the ethical implications of engineering decisions in complex organisational contexts, reinforcing professional responsibility.

These culminating experiences demonstrate students' capacity for autonomous learning, critical review, and professional self-awareness. Progression plans in the final year serve as a comprehensive record of graduate capability development, integrating evidence from capstone projects, thesis work, and leadership courses. This ensures that students, staff, and accrediting bodies can clearly track the trajectory of professional growth across the program, confirming readiness for Engineers Australia Stage 1 Competency Standards.

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