

UNSW Engineering Education Specification

1. Program Overview

Program Title: Bachelor of Engineering (Honours)

Award Title: Bachelor of Engineering (Honours) (Chemical Product Engineering)

Engineering Discipline: Chemical Product Engineering

The discipline of chemical product engineering has emerged and evolved internationally as a distinct area within chemical engineering, while sharing many of the same foundations in chemistry, physics, mathematics and process engineering. It focuses on the design and development of formulated products and microstructured materials, and is recognised in accreditation requirements and industry practice as a distinct but related specialisation within chemical engineering. The Chemical Product Engineering specialisation within the Bachelor of Engineering (Honours) at UNSW is named to reflect this disciplinary focus and to be consistent with how the field is increasingly recognised globally.

Chemical Product Engineering involves researching, developing and improving the products we use every day through the design of formulations and microstructures, the selection of raw materials, and the design of routes to manufacture. It is about taking product concepts from initial idea, through laboratory formulation and performance testing, to pilot-scale trials and commercial manufacture. At UNSW, Chemical Product Engineering students learn how to apply advanced knowledge in chemistry, materials science and chemical engineering to design and optimise complex products such as pharmaceuticals, cosmetics, personal care products, foods and industrial fluids. They learn to extrapolate small-scale laboratory work into robust, scalable and economically viable product and process solutions. These skills are critical for the Australian economy now and into the future.

The Engineers Australia Stage 1 Competency Standard forms the high-level Engineering (Honours) program learning outcomes at UNSW, which form the design specification for the specialisation.

The specialisation learning outcomes (SLOs) are mapped to the program learning outcomes (EA Stage 1 Competency Standard) to ensure those outcomes are achieved.

Course-level intended learning outcomes are, in turn, mapped to the specialisation learning outcomes to ensure that those are also achieved.

The specialisation and (where necessary) course learning outcomes are mapped to various external benchmarks, including UNSW graduate capabilities and relevant Engineers Australia guidance. The balance of outcomes achieved across the specialisation is considered by expert groups, including the School's teaching and learning committee and Industry Advisory Board, with reference to external groups such as TEQSA and Engineers Australia.

These diverse and evolving requirements together create a rather narrow feasible program design space, which we endeavour to stay within.

Where adjustments to the balance of outcomes are required as identified in periodic review, these are implemented through revisions to the stream (to adjust included courses) or to courses (to adjust the balance of content, skills, or assessment).

2. Career Alignment

Chemical Product Engineering involves researching, developing and improving the formulated products used in everyday life, including pharmaceuticals, personal care and cosmetic products, household and industrial cleaners, foods and beverages, and specialty chemicals. Chemical product engineers integrate chemistry, physics, materials science and engineering principles to design product formulations, predict and measure performance, and ensure that products are safe, sustainable and commercially viable.

Students in the Chemical Product Engineering stream develop a strong foundation in chemistry, mathematics, physics and computing, and build specialist capabilities in formulation science, colloids, polymers, complex fluids and product design. They apply this knowledge through laboratory work, design and project-based courses, and 60 days of approved industrial training, during which they experience professional practice in relevant industries.

Our Chemical Product Engineering graduates work in a broad range of industries where they contribute to the development and improvement of products and processes, often within multidisciplinary teams that include scientists, engineers, marketers and regulatory specialists. They are expected to consider safety, environmental impact, regulatory compliance, user needs and economic factors in their professional practice.

3. Specialisation Framework

The Chemical Product Engineering stream learning outcomes and their sub-outcomes describe how discipline-specific technical knowledge and engineering application skills in areas such as formulation science, colloids, polymers and complex fluids are developed and assessed across the curriculum. Together, these outcomes ensure attainment of the Engineers Australia Stage 1 competency elements across the three domains of practice (knowledge and skill base, engineering application ability, and professional and personal attributes), while also aligning with UNSW graduate capabilities.

The Chemical Product Engineering stream in the BE(Hons) aims to ensure a rigorous staging of learning, from foundational disciplinary knowledge through to advanced, integrative experiences in which students design, implement and evaluate product concepts and solutions. As an honours-level specialisation (AQF level 8), the curriculum includes advanced disciplinary content, enquiry-based learning and exposure to current research and practice. Graduates are able to critically analyse and synthesise information, design and evaluate solutions to complex product engineering problems with autonomy and professional judgement, and communicate their work effectively to diverse audiences.

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

1. Demonstrate knowledge and expertise in the use of the methods, tools and ideas from chemistry, mathematics, physics, and computing that underpin chemical product engineering.
2. Solve chemical product engineering problems in formulated materials by competent application of technical knowledge in synthetic chemistry, analytical chemistry, polymer chemistry, colloids, complex fluids, material and energy balances, thermodynamics, fluid mechanics, particulate flow, chemical reaction engineering, transport phenomena, economic analysis, and safety analysis.

3. Demonstrate engineering design expertise to create socially aware chemical product concepts and prototypes for solutions, enabling technically and economically viable products that are sustainable, safe, appropriate, and standards-compliant.
4. Use systems thinking to guide engineering practice, including articulating financial and technical constraints on product design, analysing competitive intellectual property to identify opportunities in markets and technologies, providing a basis for formulated product scale-up and manufacturing, and liaising with process engineers to judge when optimal to develop manufacturing capability or use contract manufacturers.
5. Use appropriate resources, including research data, to analyse microstructured product performance characteristics, create quantifiable product benchmarks, develop sustainable, holistic approaches while dealing with uncertainty and solving complex product engineering problems with actual social and environmental contexts.
6. Effectively manage product, material, and equipment development projects, with multidisciplinary teams of scientists, engineers and marketers with robust project planning and project management approaches that are adaptable, responsive, and appropriate in benefiting from the capabilities of diverse teams.
7. Communicate complex ideas effectively and professionally through a range of media to diverse audiences within and outside of chemical product engineering, including describing project outputs, pitching product concepts to management, technologists, and marketing, effectively incorporating, and being responsive to, feedback.
8. Conduct themselves professionally, ethically, respectfully and with integrity, being accountable as an individual, as members of teams, and as a leader of teams, while recognising the social and environmental obligations of chemical product engineers.

4. Continuous Improvement

Program design for the Chemical Product Engineering stream is informed by ongoing evaluation of student outcomes, industry feedback and emerging trends in product development. Sources include student surveys, informal feedback from current students and graduates, external examiners' reports, accreditation reports, and regular discussions with industry partners through research collaborations, guest lectures and the School's Industry Advisory Board.

These inputs inform the School's Teaching and Learning Committee and the program authority, and may lead to adjustments in course content, learning activities or assessment, or to changes in the set of courses included in the stream. In Chemical Product Engineering, recent and ongoing areas of attention include sustainability and circular economy considerations in product design, the use of data and digital tools to support formulation and performance prediction, and changing regulatory expectations for consumer and industrial products.

The shape of future demand in chemical product engineering is inherently uncertain, so the curriculum is designed to provide both a strong disciplinary foundation and flexibility to incorporate new product technologies, regulatory frameworks and professional practices. This balance is supported by regular review of learning outcomes and curriculum maps, enabling the stream to maintain core capabilities while responding to new opportunities and challenges.

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

To develop an initial draft of the SLOs, a working group was formed that included members of the school with relevant industry experience, specialists in education and curriculum design, and the stream coordinators of each stream. The group was selected to ensure diversity in professional background, industry experience, cultural background, and gender, gathering a representative set of views. Over the course of six weeks, the group progressed through a sequence of divergent then convergent phases of identifying important topics to be included in the SLOs, finding suitable wording for the SLOs, combining the work, and the refining the draft.

The draft SLOs were widely circulated for comment, critique, and suggestions around the entire academic staff of the School, the Faculty Accreditation Working Group, and the School's Industry Advisory Board. The final versions of the SLOs were endorsed by the School's Education Committee, and the industry and student members of the School's Industry Advisory Board.

The SLOs are reviewed as part of the comprehensive program review conducted at least every five years.

Verification of achievement of learning outcomes is a multi-step chain from the program learning outcomes (stage 1 competencies) mapped to specialisation learning outcomes, mapped to course learning outcomes, to assessment design and finally review of individual student work for each assessment. Each step is conducted through periodic course and program review as outlined

earlier, except for the final step verifying student work. That is conducted at all course levels during the IChemE accreditation process (every 5 years), and verified for the capstone thesis and design courses each time they are offered

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 knowledge and expertise in the use of the methods, tools and ideas from chemistry, mathematics, physics, and computing that underpin chemical product engineering.	X	X														
2. Solve chemical product engineering problems in formulated materials by competent application of technical knowledge in synthetic chemistry, analytical chemistry, polymer chemistry, colloids, complex fluids, material and energy balances, thermodynamics, fluid mechanics, chemical reaction engineering, transport phenomena, economic analysis, and safety analysis.			X				X	X								
3. Demonstrate engineering design expertise to create socially aware chemical product concepts and prototypes for solutions, enabling technically and economically viable products that are sustainable, safe, appropriate, and standards-compliant.					X	X	X		X							
4. Use systems thinking to guide engineering projects, for example to articulate financial and technical constraints on product design, analyse competitive intellectual property to identify opportunities in markets and technologies, provide a basis for formulated product scale-up and manufacturing, and liaise with process engineers to judge when optimal to develop manufacturing capability or use contract manufacturers.				X	X	X	X	X	X	X						
5. Use appropriate resources, including research data, to analyse microstructured product performance characteristics, create quantifiable product benchmarks, develop sustainable, holistic approaches while dealing with uncertainty and solving complex product engineering problems with actual social and environmental contexts.				X		X		X	X		X			X		
6. Effectively manage product, material, and equipment development projects, with multidisciplinary teams of scientists, engineers and marketers with robust project planning and project management approaches that are adaptable, responsive, and appropriate in benefiting from the capabilities of diverse teams.							X			X					X	X
7. Communicate complex ideas effectively and professionally through a range of media to diverse audiences within and outside of chemical product engineering, including describing project outputs, pitching product concepts to management, technologists, and marketing, effectively incorporating, and being responsive to, feedback.												X				
8. Conduct themselves professionally, ethically, and respectfully, be accountable as an individual, as members of teams, and as a leader of teams, while recognising the social and environmental obligations of chemical product engineers.											X		X	X	X	X

Table 2. Mapping of courses to the stream learning outcomes

CLO	1. Demonstrate knowledge and expertise in the use of the methods, tools and ideas from chemistry, mathematics, physics, and computing that underpin chemical product engineering.	2. Solve chemical product engineering problems in formulated materials by competent application of technical knowledge in synthetic chemistry, analytical chemistry, polymer chemistry, colloids, complex fluids, material and energy balances, thermodynamics,	3. Demonstrate engineering design expertise to create socially aware chemical product concepts and prototypes for solutions, enabling technically and economically viable products that are sustainable, safe, appropriate, and standards-compliant.	4. Use systems thinking to guide engineering projects, for example to articulate financial and technical constraints on product design, analyse competitive intellectual property to identify opportunities in markets and technologies, provide a basis for fo	5. Use appropriate resources, including research data, to analyse microstructured product performance characteristics, create quantifiable product benchmarks, develop sustainable, holistic approaches while dealing with uncertainty and solving complex prod	6. Effectively manage product, material, and equipment development projects, with multidisciplinary teams of scientists, engineers and marketers with robust project planning and project management approaches that are adaptable, responsive, and appropriate	7. Communicate complex ideas effectively and professionally through a range of media to diverse audiences within and outside of chemical product engineering, including describing project outputs, pitching product concepts to management, technologists, and	8. Conduct themselves professionally, ethically, and respectfully, be accountable as an individual, as members of teams, and as a leader of teams, while recognising the social and environmental obligations of chemical product engineers.
Level 1 Core Courses								
CHEM1811 Engineering Chemistry 1A	Introduced		Introduced				Introduced	Introduced
CHEM1821 Engineering Chemistry 1B	Developed		Introduced					Introduced
COMP1511 Programming Fundamentals	Introduced							
COMP1911 Computing 1A	Introduced							
DESN1000 Introduction to Engineering Design and Innovation		Introduced	Introduced		Introduced	Introduced	Introduced	Introduced
ENGG1811 Computing for Engineers	Introduced							
MATH1131 Mathematics 1A	Introduced						Introduced	
MATH1141 Higher Mathematics 1A	Introduced						Introduced	

MATH1231 Mathematics 1B	Developed							
MATH1241 Higher Mathematics 1B	Developed						Introduced	
PHYS1121 Physics 1A	Introduced				Introduced		Introduced	Introduced
PHYS1131 Higher Physics 1A	Introduced				Introduced		Introduced	Introduced
Level 2 Core Courses								
CEIC2000 Material and Energy Systems	Developed	Introduced	Developed					
CEIC2001 Fluid and Particle Mechanics	Developed	Introduced	Developed					
CEIC2002 Heat and Mass Transfer	Developed	Developed						
CEIC2005 Chemical Reaction Engineering	Developed	Developed	Developed					
CHEM2021 Organic Chemistry: Mechanisms and Biomolecules	Developed	Developed	Developed				Developed	Developed
CHEM2031 Inorganic Chemistry: The Elements	Developed	Developed					Developed	
CHEM2041 Analytical Chemistry: Essential Methods	Developed	Developed					Developed	
DESN2000 Engineering Design and Professional Practice		Developed	Developed	Introduced	Introduced	Developed	Introduced	Introduced
MATH2018 Engineering Mathematics 2D	Developed	Developed						
MATH2019 Engineering Mathematics 2E	Developed	Developed						
MATH2089 Numerical Methods and Statistics	Developed	Developed					Developed	
Level 3 Core Courses								

CEIC6712 Pharmaceutical Design and Engineering	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
CEIC6714 Hydrogen Systems Engineering and Economics	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
CEIC8105 Advanced Polymer Science and Research	Proficient	Proficient	Proficient	Proficient	Proficient		Proficient	Proficient
CEIC8330 Process Engineering in the Petroleum Industry								
CEIC8341 Membrane Processes	Proficient	Proficient	Proficient	Proficient	Proficient			Proficient
CHEN6701 Advanced Reaction Engineering	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
CHEN6703 Advanced Particle Systems Engineering	Proficient	Proficient	Proficient	Proficient	Proficient	Developed	Proficient	Proficient
ENGG2600 Engineering Vertically Integrated Project	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ENGG3001 Fundamentals of Humanitarian Engineering	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ENGG3060 Rehabilitation and Assistive Technology	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ENGG3600 Engineering Vertically Integrated Project	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ENGG3741 Introduction to Nuclear Engineering	Developed	Developed	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ENGG4060 Student Initiated Project		Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ENGG4102 Humanitarian Engineering Project	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
ENGG4111 Energy Storage	Proficient	Proficient	Proficient	Proficient	Proficient			Proficient

ENGG4600 Engineering Vertically Integrated Project	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
FOOD3010 Food Products and Ingredients Technology	Proficient	Proficient	Proficient	Proficient	Proficient		Proficient	Proficient
FOOD3801 Unit Operations in Food Processing								
FOOD4450 Advanced Food Processing	Proficient	Proficient	Proficient	Proficient	Proficient			
MECH4770 Fundamentals and Design of Electrochemical Energy Storage Systems	Proficient	Proficient	Proficient	Proficient	Proficient			Proficient

7. Assessments

The mixture of assessment types used within the stream is shown in the curriculum mapping. As is typical of many engineering streams, early-year courses are more content-driven and use a higher proportion of quizzes, tests and examinations to verify foundational knowledge and skills. As students progress, the assessment mix pivots towards project-based work, often undertaken in teams, with an increased emphasis on application, integration and professional skills.

In the Chemical Product Engineering stream, assessments in later-year courses place particular emphasis on the design, formulation and evaluation of products and processes. Typical assessment tasks include laboratory reports and practical write-ups, design dossiers and specifications, project reports, portfolios of work, and oral presentations or pitches of product concepts to technical and non-technical audiences. These tasks provide evidence for attainment of the stream learning outcomes and the Engineers Australia Stage 1 competencies, especially those related to engineering application ability and professional and personal attributes.

Across the stream, individual assessment tasks are mapped to course learning outcomes, which in turn map to stream learning outcomes and the Engineers Australia Stage 1 competencies. This mapping is used in assessment review meetings and program reviews to check that assessment supports the intended balance of outcomes, and to identify where changes may be required to improve alignment, level or load. Moderation and calibration processes, including use of common rubrics and shared exemplars, support consistency of standards across courses and over time.

CHEMICAL PRODUCT ENGINEERING

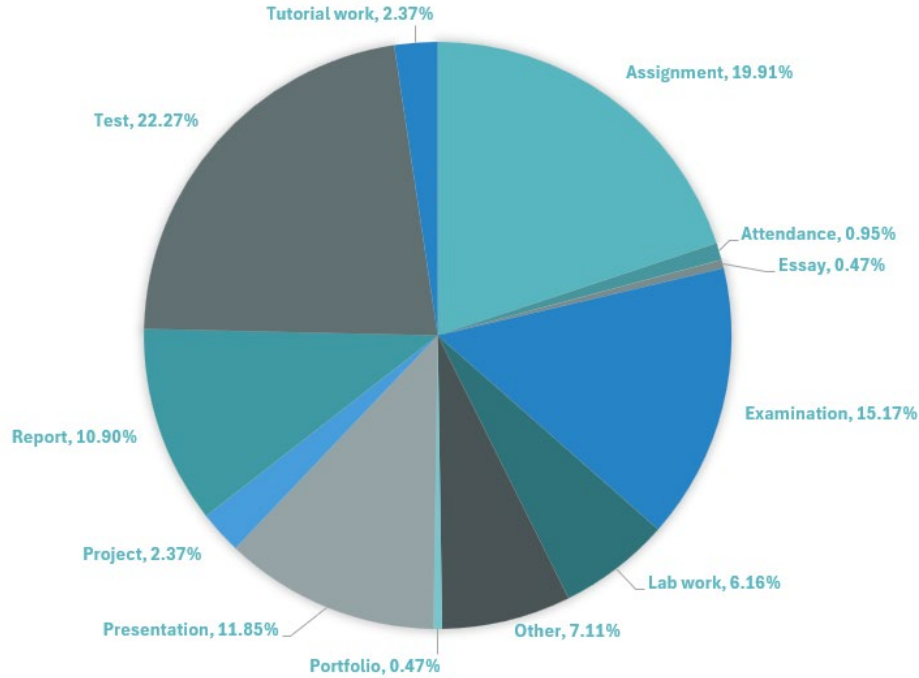


Figure 1. Percentage of assessment types used within the specialisation.

**CHEMICAL PRODUCT ENGINEERING
CORE**

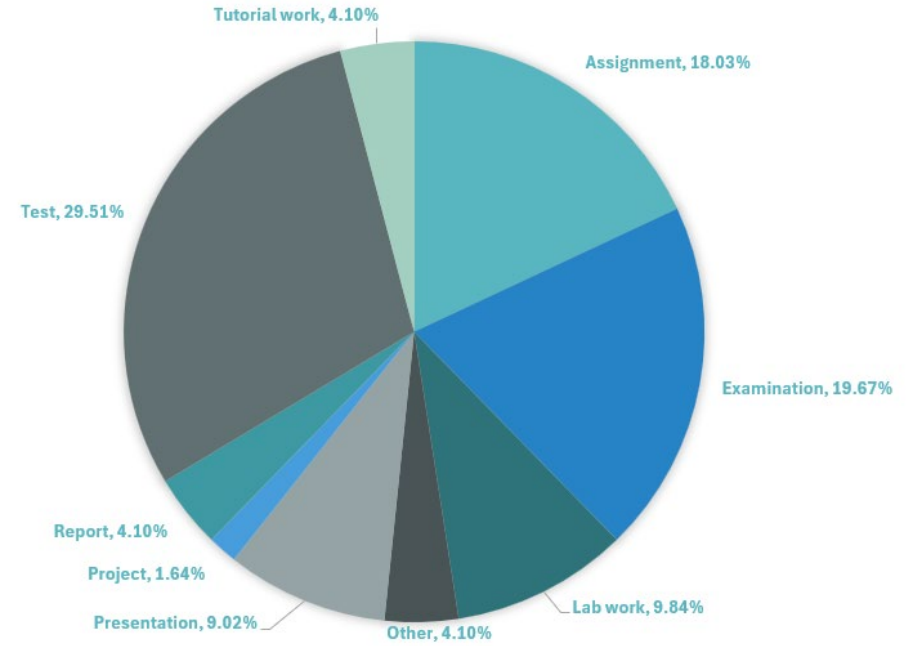


Figure 2. Percentage of assessment types used within the core of the specialisation.

CHEMICAL PRODUCT ENGINEERING ELECTIVES

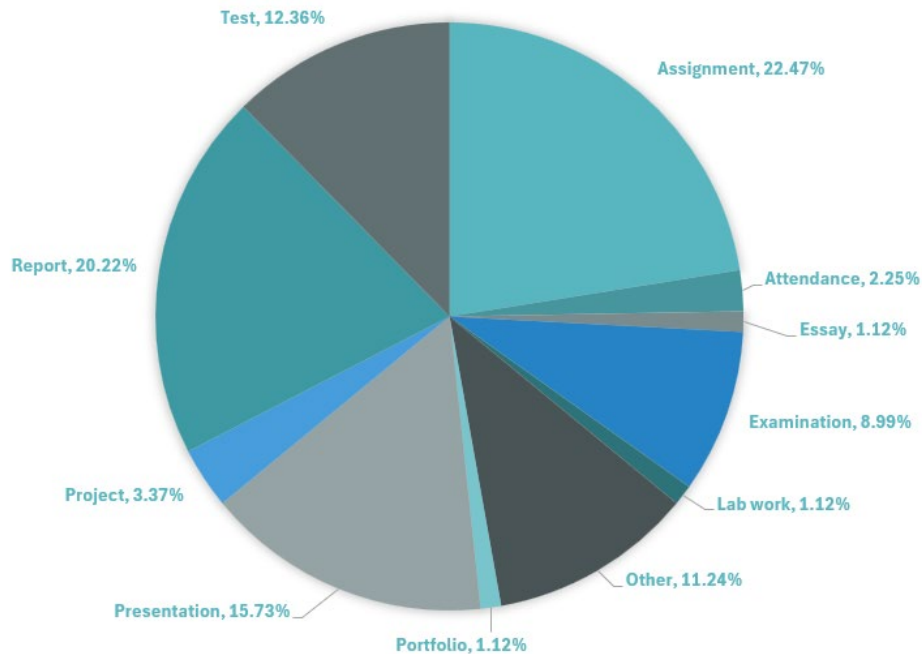


Figure 3. Percentage of assessment types used within the electives of the specialisation.

Even with the limitations of classification, it is seen that a broad range of assessment types are employed in the stream, offering many opportunities for students to demonstrate their learning, and different formats used to develop a variety of communications skills.

Reflective practice, critical review, peer and self assessment skills are developed under SLO 7 and 8, across a number of courses in the stream, especially the professional practice and design oriented courses.

Assessment design is consistent with achieving stated course learning outcomes, as assured by the governance process for course proposal and revision. Grading rubrics are developed by course coordinators consistent with the learning outcomes targeted and are monitored as part of the course review process.

The School has a range of measures in place for assessment quality and academic integrity:

- All final exam papers are peer reviewed by the School Exam Review meeting. At this meeting, papers are checked for their academic level, correctness, and clarity. Marking rubrics are also reviewed along with the measures proposed by the exam setter to check for academic integrity.
- Reports are normally submitted via Turn-It-In where appropriate. Final year theses may also be checked via Turn-It-In if there are any concerns from either marker.
- The University operates a multi-level AI permission setting which is determined at the level of individual assessment items and specified in each Course Outline. Where appropriate, assessment is designed to make attempted inappropriate AI use unhelpful, for instance by

requiring students to reflect upon their own personal beliefs or experience. There is generally some level of discussion around the appropriate use of AI for each assessment in the classroom. Inappropriate use is generally picked up through a combination of suggestive matching in Turnitin, unlikely or unusual language choice, or academic subject matter expertise. Allegations of AI misuse are handled within the University's plagiarism management procedure or complaints management and investigations policy and procedure, depending on severity.

- Worked solutions with detailed marking guides or marking rubrics are created for all assessment items and used by markers.
- Final year theses are double marked to ensure consistency; if the markers are not in reasonable agreement on the final mark, a third marker is appointed.

It is reasonable to assume that assessment practices will continue to evolve, with arguments unresolved about the best approaches to assess student learning, the impact of high stakes assessments on student welfare, and the efficacy of various assessment practices in maintaining academic integrity

8. Specialisation Progression Plan

The standard plan is shown below for the Chemical Product Engineering stream. It is noted that students may approach the stream in different sequences for a range of reasons, including Co-op Scholarship placements, international exchange, enrolment in a double degree, part-time study, commencing the degree in Term 2 or Term 3, or failing an individual course. To complement the study plan shown below, the School has developed recommended study plans for other common eventualities and these are published on the Faculty website; our Academic Advisors also work with individual students to develop study plans tailored to their circumstances.

<https://www.unsw.edu.au/engineering/student-life/student-resources/enrolment-sequences>

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](#)