UNSW Engineering

Education Specification

1. Program Overview

Program Title: Bachelor of Engineering (Honours)

Award Title: Bachelor of Engineering (Honours) (Geoenergy and Geostorage Engineering)

Engineering Discipline: Geoenergy and Geostorage Engineering

The undergraduate Geoenergy and Geostorage Engineering, MEREAH specialisation is explicitly structured to meet the Engineers Australia Stage 1 Competency Standard by integrating foundational engineering knowledge with advanced, application-focused study of subsurface energy and storage systems. Built on UNSW's long-standing strength in reservoir engineering, drilling, geomechanics and geoscience, the curriculum provides progressive development of EA's Stage 1 competency Standard.

The new specialisation is aligned with global Net Zero sustainability goals, while at the same time realising the fact that underground fluid production and injection remain a necessary engineering skill. Furthermore, better alignment with mining and civil engineering disciplines in the geotechnical area, and renewable energy for the long-term seasonal storage of energy (as hydrogen or pressure) is sought. This specialisation addresses the geostorage of CO_2, hydrogen or pressure, the utilising of geological high-salinity brines for minerals extraction, and retain some key competencies of reservoir. All these elements are reflected in the specialisation title, geoenergy and geostorage engineering.

2. Career Alignment

Core capabilities in reservoir engineering, drilling, geomechanics and formation evaluation directly align with workforce roles that carry the same titles across the energy and subsurface sectors—for example:

- Reservoir engineer
- Drilling engineer
- Geomechanics engineer
- Positions within formation evaluation teams.

Building on these fundamentals, the specialisation also prepares graduates for emerging roles in:

- Carbon capture
- Utilisation and storage (CCUS)
- Hydrogen and pressure storage
- Geothermal energy
- Subsurface integrity and monitoring
- Decommissioning.

Skills in subsurface modelling, storage security, data acquisition design, and environmental monitoring position graduates for careers as:

- CCUS project engineers
- Subsurface modellers
- Storage integrity specialists
- Geothermal engineers
- Environmental or regulatory consultants.

Because these capabilities remain essential in both traditional upstream petroleum and Net Zero–aligned industries, graduates are well equipped for a wide range of roles across energy operators, consulting firms, service companies, government agencies, and emerging clean-energy technology sectors.

3. Specialisation Framework

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

1. Identify and apply appropriate theory and methods from the underpinning physical, mathematical, computational and information sciences in order to solve problems in geoenergy and geostorage engineering.
2. Solve problems related to the sustainable extraction of energy and the storage of fluids in subsurface reservoirs by competent application of technical knowledge in geology, geophysics, reservoir engineering, and drilling engineering including risk-based design and decision making.
3. Proactively discern, synthesise and critically evaluate knowledge development and research directions within geoenergy and geostorage engineering, demonstrating a commitment to lifelong learning and practicing the forefront of the discipline.
4. Evaluate the engineering, economic, social and environmental sustainability aspects of subsurface storage and fluid extraction.
5. Characterise and simulate subsurface rock and fluids, design drilling operations, recovery and storage processes, and predict future performance.
6. Design data acquisition programs for the purpose of controlling possible environmental impacts, monitoring engineering operations and optimizing reservoir performance.
7. Communicate complex ideas effectively and professionally through a range of media to both technical and non-technical audiences, effectively incorporating feedback and being responsive to others.
8. Plan, execute and evaluate engineering projects with a high level of professionalism and adaptability, using effective management methodologies and processes.
9. Behave professionally, ethically, respectfully and with integrity, demonstrating accountability as an individual, as a member of teams, and as a leader of teams, while recognising the social and environmental obligations of geoenergy and geostorage engineers.

The attainment and application of these skills ensure that students meet the Engineers Australia Stage 1 competencies. This is recorded in the mapping of the specialisation learning outcomes with the Engineers Australia Stage 1 competencies, presented in section 6.

4. Continuous Improvement

Although MEREAH specialisation is newly established, its design has been guided by extensive consultation with industry partners, the School's Industry Advisory Board, alumni from the former Petroleum Engineering program, and feedback from current students seeking stronger alignment with the energy-transition workforce.

This consultation process identified clear demand for competencies in CCUS, hydrogen storage, geothermal systems, reservoir characterisation, drilling, and storage security which directly shaped the program structure and learning outcomes.

Ongoing continuous improvement will be achieved through these feedback cycles, course-level evaluations, and alignment with evolving professional standards such as Engineers Australia Stage 1 Competencies. As industry practices, regulatory frameworks, and energy-transition technologies evolve, the specialisation will be routinely updated to ensure that graduates remain well-prepared for emerging subsurface engineering challenges and future workforce needs.

5. Review Process

5.1. Faculty-led Review

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

The process used for curriculum mapping is described in the faculty report. Table 1 presents a detailed mapping of the Specialisation Learning Outcomes (SLOs) to the Engineers Australia Stage 1 Competencies. The matrix demonstrates that the specialisation provides systematic coverage of all required competency areas.

Table 2 presents the curriculum-level mapping of courses to the SLOs. It shows the staged development of competencies. Initial-year courses introduce the Specialisation Learning Outcomes, ensuring students acquire the necessary foundations. The 2nd and 3rd years courses build depth and progressively strengthen students' technical and professional capabilities. By Year 4, capstone and advanced discipline courses affirm proficiency across all outcomes, ensuring students meet the required graduate competency standards. This systematic alignment ensures vertical integration of learning and confirms that the Specialisation provides the necessary scaffolding for students to achieve all required capabilities before entering professional practice.

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. Identify and apply appropriate theory and methods from the underpinning physical, mathematical, computational and information sciences in order to solve problems in geoenergy and geostorage engineering.	x	x	x													
2. Solve problems related to the sustainable extraction of energy and the storage of fluids in subsurface reservoirs by competent application of technical knowledge in geology, geophysics, reservoir engineering, and drilling engineering including risk-based design and decision making.		x			x	x	x	x								
3. Proactively discern, synthesise and critically evaluate knowledge development and research directions within geoenergy and geostorage engineering, demonstrating a commitment to lifelong learning and practicing the forefront of the discipline.	x		x	x	x		x	x					x			
4. Evaluate the engineering, economic, social and environmental sustainability aspects of subsurface storage and fluid extraction.					x	x	x	x	x							
5. Characterise and simulate subsurface rock and fluids, design drilling operations, recovery and storage processes, and predict future performance.							x	x	x	x						
6. Design data acquisition programs for the purpose of controlling possible environmental impacts, monitoring engineering operations and optimizing reservoir performance.							x	x	x							
7. Communicate complex ideas effectively and professionally through a range of media to both technical and non-technical audiences, effectively incorporating feedback and being responsive to others.												x		x		
8. Plan, execute and evaluate engineering projects with a high level of professionalism and adaptability, using effective management methodologies and processes.										x	x		x	x	x	
9. Behave professionally, ethically, respectfully and with integrity, demonstrating accountability as an individual, as a member of teams, and as a leader of teams, while recognising the social and environmental obligations of geoenergy and geostorage engineers.											x			x	x	x

Table 2. Mapping of courses to the stream learning outcomes.

SLO	1. Identify and apply appropriate theory and methods from the underpinning physical, mathematical, computational and information sciences in order to solve problems in geoenergy and geostorage engineering.	2. Solve problems related to the sustainable extraction of energy and the storage of fluids in subsurface reservoirs by competent application of technical knowledge in geology, geophysics, reservoir engineering, and drilling engineering including risk-bas	3. Proactively discern, synthesise and critically evaluate knowledge development and research directions within geoenergy and geostorage engineering, demonstrating a commitment to lifelong learning and practicing the forefront of the discipline.	4. Evaluate the engineering, economic, social and environmental sustainability aspects of subsurface storage and fluid extraction.	5. Characterise and simulate subsurface rock and fluids, design drilling operations, recovery and storage processes, and predict future performance.	6. Design data acquisition programs for the purpose of controlling possible environmental impacts, monitoring engineering operations and optimizing reservoir performance.	7. Communicate complex ideas effectively and professionally through a range of media to both technical and non-technical audiences, effectively incorporating feedback and being responsive to others.	8. Plan, execute and evaluate engineering projects with a high level of professionalism and adaptability, using effective management methodologies and processes.	9. Behave professionally, ethically, respectfully and with integrity, demonstrating accountability as an individual, as a member of teams, and as a leader of teams, while recognising the social and environmental obligations of geoenergy and geostorage eng
Level 1 Core Courses									
DESN1000 Introduction to Engineering Design and Innovation	Introduced			Introduced			Introduced	Introduced	Developed
ENGG1811 Computing for Engineers	Introduced					Introduced			
GEOS1111 Investigating Earth and Its Evolution	Introduced	Introduced	Introduced	Introduced			Developed		
MATH1131 Mathematics 1A	Introduced	Introduced	Introduced			Introduced	Introduced		
MATH1141 Higher Mathematics 1A	Introduced	Introduced	Introduced			Introduced	Introduced		
MATH1231 Mathematics 1B	Developed	Introduced	Introduced			Introduced	Developed		
MATH1241 Higher Mathematics 1B	Developed	Introduced	Introduced			Introduced	Developed		
PHYS1121 Physics 1A	Introduced		Introduced	Introduced		Introduced			Introduced
PHYS1131 Higher Physics 1A	Introduced		Introduced	Introduced		Introduced			Introduced
Level 2 Core Courses									
DESN2000 Engineering Design and Professional Practice	Developed	Developed	Developed	Developed			Developed	Developed	Developed
ENGG2400 Mechanics of Solids 1		Introduced	Introduced				Developed	Developed	Developed
ENGG2500 Fluid Mechanics for Engineers	Developed	Developed	Introduced						

MATH2018 Engineering Mathematics 2D	Proficient	Developed							
MATH2019 Engineering Mathematics 2E	Proficient	Developed							
MATH2089 Numerical Methods and Statistics	Proficient	Introduced	Introduced		Introduced				
MERE2810 Mineral Resource Geology and Geophysics	Introduced	Developed	Developed		Developed	Developed			
MMAN2700 Thermodynamics	Developed	Developed							
Level 3 Core Courses									
MERE3001 Formation Evaluation	Proficient				Proficient	Proficient	Proficient		
MERE3002 Drilling and Completion Engineering		Proficient	Proficient		Proficient		Proficient		
MERE3003 Reservoir Engineering		Developed		Developed					
MERE5003 Transient Flow Analysis	Proficient	Proficient	Proficient		Proficient		Proficient		
MERE5004 Reservoir Characterisation and Data Science	Proficient	Developed	Developed		Proficient	Proficient			Proficient
MERE5005 Resources Project Economics		Proficient		Proficient				Proficient	
MINE3310 Mining Geomechanics (Replaced by PTRL5100)	Proficient	Proficient	Proficient	Developed	Proficient	Developed		Developed	Proficient
Level 4 Core Courses									
MERE4951 Research Thesis A	Proficient	Proficient	Proficient	Proficient		Proficient	Proficient	Proficient	Proficient
MERE4952 Research Thesis B	Proficient	Proficient	Proficient	Proficient		Proficient	Proficient	Proficient	Proficient
MERE4953 Research Thesis C	Proficient	Proficient	Proficient	Proficient		Proficient	Proficient	Proficient	Proficient
MERE5006 Decommissioning and Sustainability	Proficient	Proficient	Proficient	Proficient		Proficient			
MERE5007 Geostorage Modelling	Proficient	Proficient			Proficient		Proficient		
MERE5008 Geostorage Project	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient		Proficient
Discipline (Depth) Electives									
AVIA3013 Managing Safety and Risk at Work						Proficient		Proficient	Proficient
CEIC8204 Entrepreneurship and the Innovation Cycle			Proficient	Proficient		Proficient	Proficient	Proficient	Proficient
CVEN3502 Water and Wastewater Engineering	Proficient	Proficient	Proficient		Proficient				
ELEC4445 Entrepreneurial Engineering			Proficient	Proficient			Proficient	Proficient	Proficient
ENGG2600 Engineering Vertically Integrated Project	Proficient	Proficient	Proficient	Proficient			Proficient	Proficient	Proficient

ENGG3600 Engineering Vertically Integrated Project	Proficient	Proficient	Proficient	Proficient			Proficient	Proficient	Proficient
ENGG4600 Engineering Vertically Integrated Project	Proficient	Proficient	Proficient	Proficient			Proficient	Proficient	Proficient
PTRL5119 Geothermal Engineering	Proficient	Proficient	Proficient	Proficient			Proficient		
Free Electives									
MERE1001 Introduction to Carbon Capture Utilisation and Storage	Introduced	Introduced	Introduced	Introduced	Introduced				
CHEM1811 Engineering Chemistry 1A	Introduced								Introduced

7. Assessments

Assessment in the Geoenergy and Geostorage Engineering specialisation is designed to validate course learning outcomes while progressively verifying specialisation-level graduate capabilities. A balanced mix of examinations, tests, assignments, laboratory work, projects, presentations, reports and tutorial activities ensures that both conceptual understanding and applied engineering skills are assessed (see Figure 1). Reflective practice and critical review are developed through post-lab reflections, design critiques, and thesis/project progress reviews as presented in Figure 2. Self-assessment and peer assessment are embedded in group design tasks and project work, supporting teamwork, leadership and feedback literacy.

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

- All exam papers are reviewed by another academic. The reviewer will also be given the rubric and worked solution. When a paper is written by a new academic it will be reviewed by a Professor or A/Prof to ensure standards are being maintained. Admin staff follow up to ensure all papers have been reviewed.
- Reports are submitted using TurnItIn, which ensures that students are not plagiarising or colluding.
- Academics provide rubrics and worked solutions to markers. In this case the academic will re-mark a sample of the reports or exam papers to ensure the rubric is being used correctly.
- Important works, such as thesis, will have two markers to ensure consistency.

Broadly speaking, students are using generative AI. UNSW has instituted a '6-lane' approach to the use of generative AI for the completion of assessment tasks.[1] At the start of each term, course convenors review their assessment tasks and decide on the level of generative AI permissible.

Overall, assessment tasks and grading schemas are intentionally aligned with the intended learning outcomes of each course and collectively serve to confirm graduates' technical competence, communication skills, professional behaviour, and readiness for practice in subsurface engineering fields.

[1] This approach is described on the university website: https://www.unsw.edu.au/student/managing-your-studies/academic-skills-support/toolkit/ai

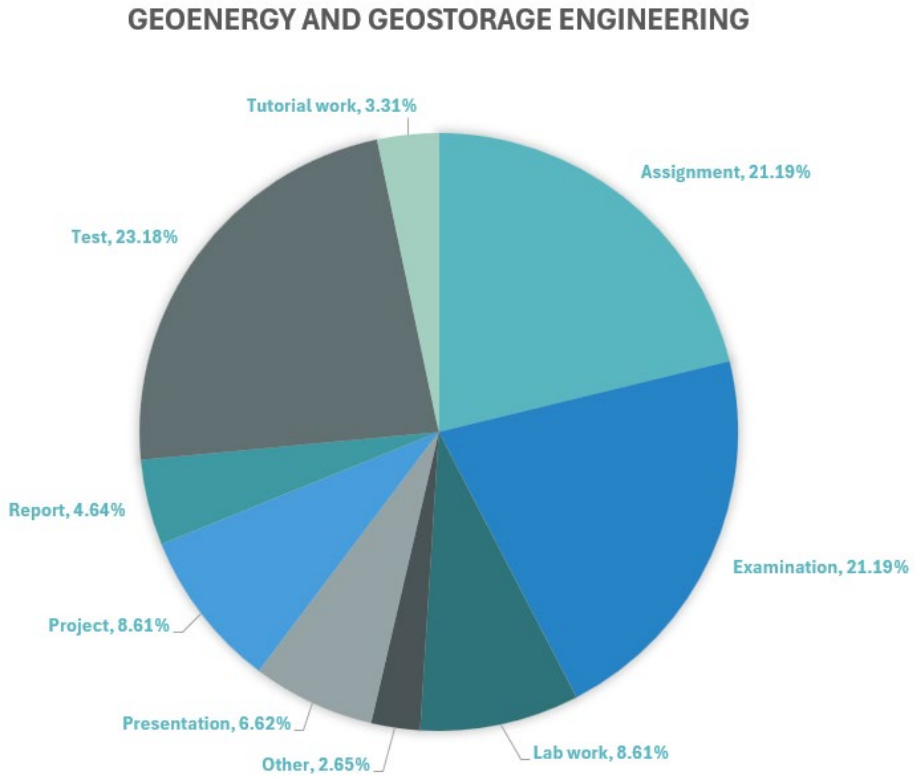

Figure 1. Percentage of assessment types used within the specialisation.

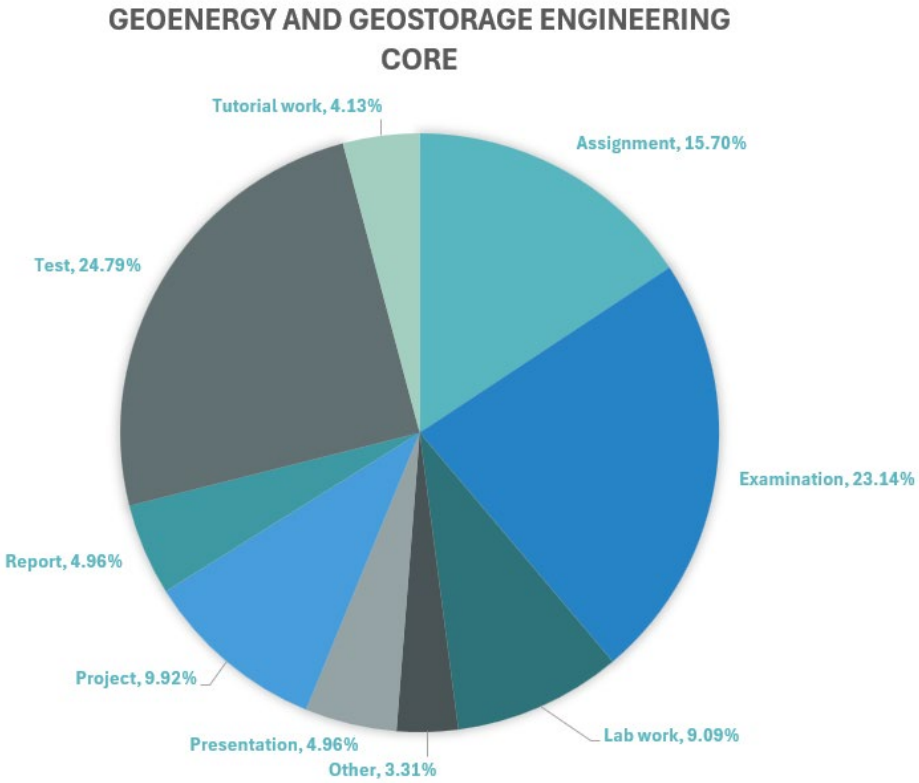

Figure 2. Percentage of assessment types used within the core of the specialisation.

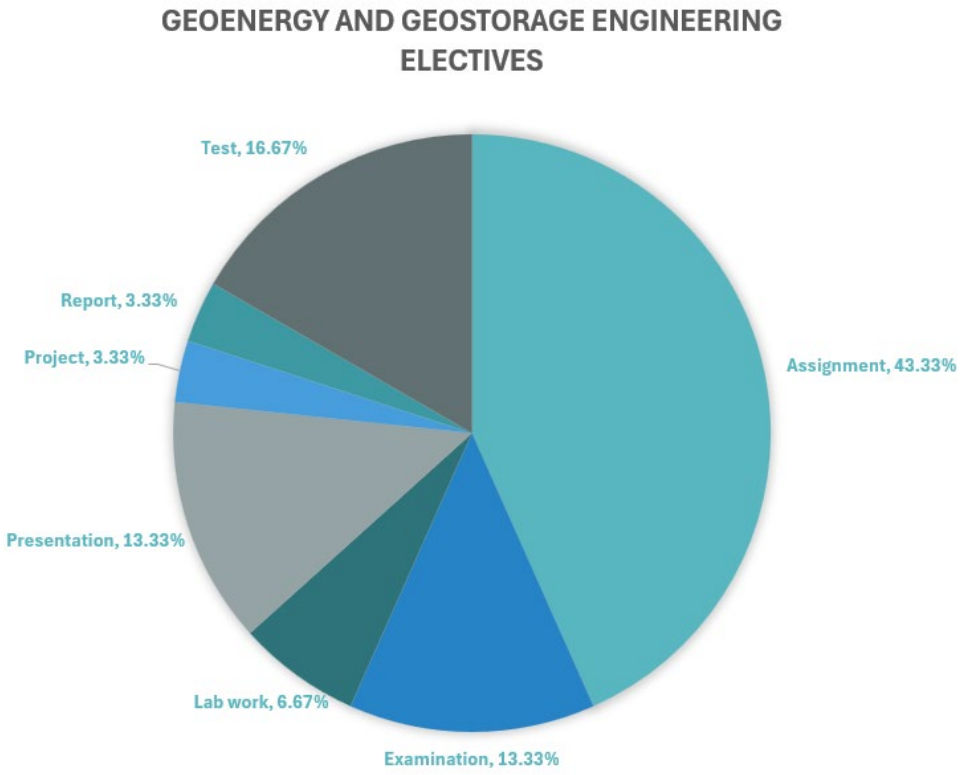

Figure 3. Percentage of assessment types used within the electives of the specialisation.

8. Specialisation Progression Plan

The program supports student reflection and self-assessment through a structured progression framework. The UNSW Handbook provides program rules and example T1/T2/T3 progression plans, and the myPlan tool enables students to map their enrolment choices against program requirements and monitor their capability development over time. Additional support is provided by the UNSW Nucleus Student Hub, which assists students with progression checking, prerequisite planning and enrolment sequencing, enabling ongoing self-monitoring of academic and professional growth throughout the program.

Each course includes at least one assessment marked before census date, allowing students to gauge their understanding and adjust their enrolment or study strategies as needed. A consistent philosophy of feedback—incorporating formative comments and reflective assessment tasks—encourages students to evaluate their learning, recognise strengths, and identify areas for further development.

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