MINEAH Mining Engineering

Introduction

This report shows how the MINEAH Mining Engineering stream of the 3707 Bachelor of Engineering (Honours) program at UNSW fosters the Engineers Australia Level 1 Graduate Competencies in its students. It starts by addressing the overall aims of the stream and its uniqueness. It then covers the stream plan followed by the Stream Learning Outcomes. The process for developing and obtaining feedback to improve these SLOs is detailed. This is followed by the curriculum mapping that relates the individual courses to the Stream Learning Outcomes, the Stream Learning Outcomes to the Graduate Capabilities and the individual courses to the Graduate Capabilities.

Aims of the Stream

Mining Engineering stream prepares students to extract natural minerals from the earth and processing them with safety and minimal environmental impact. The focus is on environmentally responsible recovery, processing, marketing and financial management of mineral resources. A solid foundation of fundamental engineering principles and their intelligent application to complex mining systems is an integral part of this stream. It embraces technical skills in areas such as mining systems, geomechanics, mine planning and design, ventilation, and protection of our environments. Mining Engineering graduates will have AQF level 8 skills i.e., advanced cognitive, technical and communication skills to select and apply methods and technologies to analyse, generate and transmit solutions to complex mining problems. The graduates work in areas such as drilling, blasting, project management, sustainability, quarry and tunnelling, community relations and management consulting in mining companies, investment firms, finance, banking, and government organisations.

In the 3rd and/or final year of the Mining Engineering stream students may choose electives in Surface Mining Systems, Underground Mining Systems, Advanced Ventilation, Asset management or Mining in a global environment. The program is normally taken on a four-year full-time basis.

Mineral & Mining Engineering is the highest-ranking UNSW subject and third in the world, as per 2022 QS ranking. This is its sixth year in the top 10 and as UNSW's best-performing subject. The Mining Engineering Stream at UNSW has close links with key professional, commercial, and industrial organisations.

Stream Plan

Course code	Course name
Year 1	
Term 1	

DESN1000	Introduction to Engineering Design and Innovation
MATH1131 or MATH1141	Mathematics 1A Higher Mathematics 1A
ENGG1811	Computing for Engineers
Term 2	
MATH1231 or MATH1241	Mathematics 1B Higher Mathematics 1B
PHYS1121 or PHYS1131	Physics 1A Higher Physics 1A
First Year Elective	Recommended: MINE1010 Mineral Resources Engineering
Term 3	
ENGG1300	Engineering Mechanics
First Year Elective	Recommended: GEOS 1111 Investigating Earth and Its Evolution or MATS1101 Introduction to Fluid Flow and Heat Transfer
Year 2	
Term 1	
ENGG2400	Mechanics of Solids 1
MATH2019	Engineering Mathematics 2E
MATH2089	Numerical Methods and Statistics
Term 2	
MATS2005	Intro to Fluid Flow and Heat Transfer
MINE2610	Mining Services
DESN2000	Engineering Design and Professional Practice
Term 3	
MNIE2810	Minerals and Processing
Gen. Ed.	General Education
Year 3	
Term 1	
MINE3220	Resources Estimation
MINE3310	Mining Geomechanics
MINE3430	Mining Systems
Term 2	
MINE3230	Mine Planning
MINE3910	Socio-Environmental Aspects of Mining
DKC	Disciplinary Knowledge Course - 1
Term 3	
MINE3510	Mine Ventilation
MINE3630	Rock Breakage
Year 4	

Term 1	
MINE4250	HardRock Mine Design & Feasibility
MINE4310	Mine Geotechnical Engineering
MERE4951	Research Thesis A
Term 2	
MINE4260	Coal Mine Design and Feasibility
MINE4710	Mine Management
MERE4952	Research Thesis B
Term 3	
MERE4953	Research Thesis C
DKC	Disciplinary Knowledge Course - 2
Gen. Ed.	General Education

Stream Learning Outcomes

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

Knowledge

1. Appreciation of the economic factors and drivers for the mining industry.

2. Embedded level of understanding and commitment to applying the principles of sustainable mining practices including socio-economic and environmental impacts.

Skills

3. Ability to plan, design, create, innovate, and manage rapidly changing technologies and complex datasets within the mining industry.

4. Ability to take a holistic view of all systems within a mining operation through comprehensive technical engineering knowledge and skills.

5. Advanced problem solving, analysis and synthesis skills and the ability to tolerate ambiguity.

6. Ability to think and work individually as well as communicate and engage effectively with a diverse range of stakeholders.

Application of Knowledge and Skills

7. Being resilient and adaptable to all forms of mining in changing conditions and multi-cultural environments (both national and international).

8. Awareness and ongoing commitment to appropriate professional standards, the highest principles of ethical conduct, and lifelong learning.

9. Commitment to a risk-based management approach and a strong safety culture.

Development of Stream Learning Outcomes

The initial significant work done to develop the Stream Learning Outcomes (SLOs) is rooted in the DYD (define your discipline) project conducted by the Mining Education Australia (MEA) in 2015. MEA was a consortium of UNSW, UQ, University of Adelaide and Curtin University to design, develop and provide common 3rd and 4th year curriculum to mining engineering graduates. The DYD process has laid the Graduate Capability Framework for the Mining Engineering Degree Programme based on comprehensive consultation with mining academics of the 4 partnered universities, students, and industry. In 2020, a task group was set by the Head of the School (HOS) to refine the MEA graduate attributes to develop MINEAH SLOs. The task force consisted of two senior professors, HOS and the undergraduate director of teaching. The developed SLOs were circulated with all mining academics in the School and discussed with students in a focused consultation. SLOs were then presented to the School Teaching and Learning Committee (TLC) and Industry Advisory Board (IAB).

The final version of the SLOs incorporated all the comments from the TLC, students, and IAB. The final SLOs were then resubmitted to the TLC, School Management Committee (SMC) and IAB in turn for final endorsement.

Curriculum Mapping

Students can select two electives in first year and one elective each in 3rd and 4th year besides two General Education courses. Following curriculum mapping excludes General Education and two elective courses.

For the first-year electives students are recommended to enrol in MINE1010 and GEOS1111 or MATS1101. The most popular elective choices are GEOS1111 and MINE1010 and so these have been included in the mapping.

Table 1. Mapping from courses to Stream Learning Outcomes

CO → SLO Mapping	Stream Learning Outcomes (SLOs)								
Courses (CO)	SLO1	SLO2	SLO3	SLO4	SLO5	SLO6	SLO7	SLO8	SLO9
DESN1000	0.0	0.0	56.7	4.2	0.0	17.1	0.0	0.0	22.1
ENGG1300	0.0	14.2	56.7	14.2	0.0	15.0	0.0	0.0	0.0
ENGG1811	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
GEOS1111	0.0	0.0	46.0	54.0	0.0	0.0	0.0	0.0	0.0
MATH1131	0.0	0.0	16.3	0.0	83.7	0.0	0.0	0.0	0.0
MATH1231	0.0	0.0	16.3	0.0	83.7	0.0	0.0	0.0	0.0
MINE1010	20.8	20.8	19.5	0.0	29.2	0.0	0.0	0.0	9.8
PHYS1121	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
CVEN2301	0.0	34.0	38.7	0.0	27.3	0.0	0.0	0.0	0.0
DESN2000	0.0	0.0	30.2	12.7	24.5	22.7	0.0	10.0	0.0
MATH2019	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	0.0
MATH2089	0.0	0.0	0.0	35.1	64.9	0.0	0.0	0.0	0.0
MATS2005	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
MINE2610	0.0	0.0	67.5	32.5	0.0	0.0	0.0	0.0	0.0
MINE2810	0.0	0.0	14.3	85.7	0.0	0.0	0.0	0.0	0.0
MINE3220	50.0	0.0	3.6	3.6	25.0	3.6	0.0	14.3	0.0
MINE3230	28.6	0.0	14.3	28.6	14.3	7.1	7.1	0.0	0.0
MINE3310	0.0	20.4	20.4	18.3	20.4	11.2	9.2	0.0	0.0
MINE3430	8.3	33.3	33.3	16.7	0.0	0.0	0.0	0.0	8.3
MINE3510	7.1	14.2	14.2	7.1	15.0	0.0	14.2	7.1	21.2
MINE3630	8.3	25.0	16.7	16.7	16.7	0.0	8.3	0.0	8.3
MINE3910	0.0	6.2	0.0	25.0	0.0	0.0	43.8	18.8	6.2
MERE4951	0.0	0.0	20.0	10.0	40.0	20.0	0.0	10.0	0.0
MERE4952	0.0	0.0	20.0	10.0	40.0	20.0	0.0	10.0	0.0
MERE4953	0.0	0.0	20.0	10.0	40.0	20.0	0.0	10.0	0.0
MINE4250	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
MINE4260	6.7	6.7	6.7	6.7	11.1	44.4	11.1	0.0	6.7
MINE4310	0.0	22.2	22.2	11.1	22.2	0.0	0.0	11.1	11.1
MINE4710	2.5	11.3	0.0	6.2	2.5	19.8	9.6	18.3	29.9

The courses CLO mapping reflects relatively higher emphasis on SLO 5, SLO3 and SLO4. This justifies the applied and skill-oriented nature of the Mining Engineering stream.

Table 2. Mapping from courses to EA Stage 1 Graduate Capabilities

Curriculum Mapping	Engineers Australia Stage 1 Competencies															
Courses (CO)	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	3.5	3.6
DESN1000	0.6	0.6	0.6	9.4	10.0	-	10.0	10.0	10.0	26.4	-	4.3	9.4	-	4.3	4.3
ENGG1300	2.0	2.0	2.0	9.4	14.3	2.8	14.3	14.3	14.3	3.8	-	3.8	9.4	-	3.8	3.8
ENGG1811	-	-	-	16.7	16.7	-	16.7	16.7	16.7	-	-	-	16.7	-	-	-
GEOS1111	7.7	7.7	7.7	7.7	15.4	-	15.4	15.4	15.4	-	-	-	7.7	-	-	-
MATH1131	12.0	12.0	12.0	2.7	14.7	-	14.7	14.7	14.7	-	-	-	2.7	-	-	-
MATH1231	12.0	12.0	12.0	2.7	14.7	-	14.7	14.7	14.7	-	-	-	2.7	-	-	-
MINE1010	4.2	4.2	4.2	6.7	15.0	7.6	15.0	15.0	15.0	9.8	-	-	3.2	-	-	-
PHYS1121	14.3	14.3	14.3	-	14.3	-	14.3	14.3	14.3	-	-	-	-	-	-	-
CVEN2301	3.9	3.9	3.9	6.4	17.1	6.8	17.1	17.1	17.1	-	-	-	6.4	-	-	-
DESN2000	5.3	5.3	5.3	5.0	10.3	-	10.3	10.3	10.3	5.7	5.0	5.7	5.0	5.0	5.7	5.7
MATH2019	7.1	7.1	7.1	8.3	15.5	-	15.5	15.5	15.5	-	-	-	8.3	-	-	-
MATH2089	14.3	14.3	14.3	-	14.3	-	14.3	14.3	14.3	-	-	-	-	-	-	-
MATS2005	14.3	14.3	14.3	-	14.3	-	14.3	14.3	14.3	-	-	-	-	-	-	-
MINE2610	4.6	4.6	4.6	11.2	15.9	-	15.9	15.9	15.9	-	-	-	11.2	-	-	-
MINE2810	12.2	12.2	12.2	2.4	14.6	-	14.6	14.6	14.6	-	-	-	2.4	-	-	-
MINE3220	4.1	4.1	4.1	8.9	13.0	8.3	13.0	13.0	13.0	0.9	7.1	0.9	0.6	7.1	0.9	0.9
MINE3230	6.1	6.1	6.1	7.1	13.3	4.8	13.3	13.3	13.3	3.6	-	3.6	2.4	-	3.6	3.6
MINE3310	5.5	5.5	5.5	3.4	13.0	4.1	13.0	13.0	13.0	5.1	-	5.1	3.4	-	5.1	5.1
MINE3430	2.4	2.4	2.4	6.9	16.0	8.1	16.0	16.0	16.0	8.3	-	-	5.6	-	-	-
MINE3510	3.2	3.2	3.2	3.5	9.5	4.0	9.5	9.5	9.5	24.8	3.5	3.5	2.4	3.5	3.5	3.5
MINE3630	4.8	4.8	4.8	4.2	13.9	6.4	13.9	13.9	13.9	10.4	-	2.1	2.8	-	2.1	2.1
MINE3910	3.6	3.6	3.6	-	4.8	1.2	4.8	4.8	4.8	17.2	9.4	10.9	-	9.4	10.9	10.9
MERE4951	7.1	7.1	7.1	3.3	10.5	-	10.5	10.5	10.5	5.0	5.0	5.0	3.3	5.0	5.0	5.0
MERE4952	7.1	7.1	7.1	3.3	10.5	-	10.5	10.5	10.5	5.0	5.0	5.0	3.3	5.0	5.0	5.0
MERE4953	7.1	7.1	7.1	3.3	10.5	-	10.5	10.5	10.5	5.0	5.0	5.0	3.3	5.0	5.0	5.0
MINE4250	3.2	3.2	3.2	3.7	9.1	4.1	9.1	9.1	9.1	16.7	5.6	5.6	1.9	5.6	5.6	5.6
MINE4260	2.5	2.5	2.5	2.2	6.1	2.4	6.1	6.1	6.1	20.6	-	13.9	1.1	-	13.9	13.9
MINE4310	4.8	4.8	4.8	3.7	12.9	4.4	12.9	12.9	12.9	11.1	5.6	-	3.7	5.6	-	-
MINE4710	1.2	1.2	1.2	0.4	3.9	2.7	3.9	3.9	3.9	37.2	9.1	7.3	-	9.1	7.3	7.3
Cognitive Scale	5.0	5.0	5.0	4.6	10.1	3.8	10.1	10.1	10.1	9.6	4.8	4.3	4.0	4.8	4.3	4.3

Relatively higher emphasis on 1.5, 2.1, 2.2, 2.3 and 2.4 Stage 1 competencies in the stream again demonstrates the strong focus on design practice and engineering application ability.

Reflection on Strengths Weaknesses and Future Action

Strengths

The stream is particularly strong in specialist engineering knowledge, the use of design, analysis and computation tools, and design of innovative engineering solutions and systems. Thus, students will graduate with a sound ability to perform technical engineering work. The stream also rates well in terms of project management / teamwork skills and communication skills. Mining Engineering being highly applied stream the curriculum mapping reflects a strong emphasis on engineering application ability.

Weaknesses

The stream appears to have weaknesses in the areas of ethics and sustainable development. This is caused by those skills being developed in courses that also focus on other skills such as teamwork and communication and so the Cognitive Scale Contribution tends to be shared with these other skills.

Future Action

The School is in the process of implementing a strategic direction of embedding ethics and sustainability more generally in the stream from start to finish, whereas previously the coverage of ethics/sustainability had been concentrated in a smaller number of courses. More accurate redesign of assessments and a revision of the curriculum mapping is planned.

Assessment and Academic Integrity

For the technical courses in the stream 50% to 70% of the assessment is in the form of quizzes and exams. The remainder of the assessment is usually in the form of assignments, most commonly in a report format. Additionally, assessment in laboratories occurs in Mineral processing, Mine Ventilation and Mine Geomechanics courses.

Thesis and Design courses, revolve around a major work of the thesis or design project, with draft sections of these works assessed as the course progresses to give the students formative feedback. Assessments such as video presentations, interviews and presentation to industry panel are also used to improve student communication skills and increase academic integrity.

Table 3. Mapping from courses to Assessment Types

CO → AT Mapping	Assessment Types (AT)											
Courses (CO)	Assi	Essa	Exam	Lab	Othe	Perf	Port	Pres	Proj	Repo	Test	Tut
DESN1000	-	5	-	-	20	-	15	15	-	45	-	-
ENGG1300	15	-	75	-	10	-	-	-	-	-	-	-
ENGG1811	20	-	70	10	-	-	-	-	-	-	-	-
GEOS1111	-	-	-	-	40	-	-	-	-	20	40	-
MATH1131	10	-	50	-	40	-	-	-	-	-	-	-
MATH1231	10	-	50	-	40	-	-	-	-	-	-	-
MINE1010	-	-	-	-	28	-	-	-	22	50	-	-
PHYS1121	-	-	50	20	30	-	-	-	-	-	-	-
CVEN2301	-	-	60	-	20	-	-	-	-	-	20	-
DESN2000	25	-	-	-	60	-	-	15	-	-	-	-
MATH2019	-	-	60	-	10	-	-	-	-	-	30	-
MATH2089	-	-	60	-	20	-	-	-	-	-	20	-
MATS2005	-	-	70	-	-	-	-	-	20	-	10	-
MINE2610	-	-	50	-	30	-	-	20	-	-	-	-
MINE2810	-	-	25	25	-	-	-	-	-	25	25	-
MINE3220	-	-	60	-	-	-	-	-	40	-	-	-
MINE3230	-	-	40	-	-	-	-	-	40	-	20	-
MINE3310	30	-	40	-	20	-	-	-	-	10	-	-
MINE3430	-	-	40	-	-	-	20	-	-	-	40	-
MINE3510	-	-	50	-	20	-	-	-	-	30	-	-
MINE3630	-	-	35	-	-	-	-	10	-	25	30	-
MINE3910	50	-	-	-	20	-	-	-	-	-	30	-
MERE4951	-	-	-	-	-	-	-	-	100	-	-	-
MERE4952	-	-	-	-	-	-	-	-	100	-	-	-
MERE4953	-	-	-	-	-	-	-	-	100	-	-	-
MINE4250	-	-	-	-	25	-	-	25	-	50	-	-
MINE4260	-	-	-	-	25	-	-	25	-	50	-	-
MINE4310	-	-	50	-	-	-	-	-	-	40	10	-
MINE4710	-	-	-	-	40	-	-	-	-	20	40	-

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.

Due to COVID all exams have moved online, so standard practices have been adopted including:

- Exams take place at a set time, so that students need to focus on their own exams.
- Questions are Googled before and after the exam. Before ensures the questions are not easy to answer with simple searches. After ensures that the papers have not been uploaded during the exam.
- Wherever practical, more than one set of question papers are prepared to include variability and avoid possible unfair means to attend the online exam.

Summary

A curriculum mapping exercise has been carried out for the MINEAH Mining Engineering stream of the 3707 Bachelor of Engineering (Honours) program at UNSW. The stream provides good coverage of all the Engineers Australia Stage 1 Graduate Competencies. It is particularly strong in specialist engineering knowledge, the use of design, analysis and computation tools, and design of innovative engineering solutions and systems. Future direction for the stream involves working on embedding ethics and sustainability more widely throughout the stream instead of focusing it in a limited number of courses. The stream has rigorous and varied assessment tasks, which have been updated and adapted to deal with the advent of COVID-19.

PETRAH Petroleum Engineering

Introduction

This report seeks to develop the links between the PETRAH Petroleum Engineering stream of the 3707 Bachelor of Engineering (Honours) program at UNSW and the Engineers Australia Level 1 Graduate Competencies in its students. It starts by addressing the overall aims of the stream and then covers the stream plan followed by the Stream Learning Outcomes. The process for developing the SLOs is then explained followed by the curriculum mapping that relates the individual courses to the Stream Learning Outcomes, the Stream Learning Outcomes to the Graduate Capabilities and the individual courses to the Graduate Capabilities.

Aims of the Stream

The Petroleum Engineering stream prepares students to work in oil and gas industry and to know how to produce oil and gas from natural reservoirs safely and in an environmentally acceptable manner. Students will be able to apply their broad knowledge of engineering to explore the hydrocarbon reservoirs, assess their potential production and production feasibility and use available designs to produce the hydrocarbon. They also learn the standard industry practice in field development and the elemental design of hydrocarbon production. The stream covers four major engineering practices in petroleum discipline including exploration, drilling, reservoir and production engineering. The stream is designed to produce AQF level-8 graduates who will have advanced cognitive, technical and communication skills to select and apply methods and technologies to analyse, generate and transmit solutions to complex petroleum engineering problems

Mineral & Mining Engineering is the highest-ranking UNSW subject and third in the world, as per 2022 QS ranking. This is its sixth year in the top 10 and as UNSW's best-performing subject. Petroleum engineering is the first of its kind offering petroleum engineering degrees in Australia.

Stream Plan

Course code	Course name
Year 1	
Term 1	
DESN1000	Introduction to Engineering Design and Innovation
MATH1131 or MATH1141	Mathematics 1A Higher Mathematics 1A
ENGG1811	Computing for Engineers
Term 2	
MATH1231 or MATH1241	Mathematics 1B Higher Mathematics 1B
PHYS1121 or PHYS1131	Physics 1A Higher Physics 1A
First Year Elective	Recommended: MINE1010 Mineral Resources Engineering
Term 3	
MATS1101	Engineering Materials and Chemistry
First Year Elective	Recommended: MINE1010 Mineral Resources Engineering
Year 2	
Term 1	
PTRL2019	Reservoir Engineering A
MATH2019	Engineering Mathematics 2E
CEIC2001	Fluid and Particle Mechanics
Term 2	
PTRL2020	Petrophysics
PTRL2114	Petroleum Geophysics
PTRL3001	Reservoir Engineering B
Term 3	

PTRL2010	Business Practices in the Petroleum Industry
DESN2000	Engineering Design and Professional Practice
Year 3	
Term 1	
PTRL3025	Petroleum Economics
PTRL3015	Well Drilling Equipment and Operations
General Education	General Education
Term 2	
PTRL2030	Field Development Geology
PTRL3030	Reservoir Characterisation
Elective	Elective Course - 1
Term 3	
PTRL3050	Well Pressure Testing
PTRL3040	Numerical Reservoir Simulation
Year 4	
Term 1	
PTRL4012	Enhanced Oil and Gas Recovery
PTRL4020	Natural Gas Engineering
MERE4951	Research Thesis A
Term 2	
PTRL4017	Well Technology
PTRL4021	Petroleum Production Engineering
MERE4952	Research Thesis B
Term 3	
MERE4953	Research Thesis C
Elective	Elective Course - 2
Gen. Ed.	General Education

Stream Learning Outcomes

On successful completion of this program, graduates will possess following.

Knowledge

1. Knowledge of engineering and economic aspects of evaluating subsurface reservoirs and the issues involved in estimating their value.

2. In-depth knowledge of the main streams of petroleum engineering: geology and geophysics, reservoir engineering, drilling, and production engineering including risk-based design and decision making.

3. Able to characterise and simulate subsurface rock and fluids, design drilling operations and recovery processes, and predict future performance.

Skills

4. Able to integrate knowledge of mathematics and basic sciences including geosciences to the solution of problems related to the sustainable extraction of energy or storage of fluids including carbon dioxide in subsurface reservoirs.

5. Conceptual understanding of the design of data collection and acquisition programs for the purpose of controlling possible environmental impacts, monitoring engineering operations and optimizing reservoir performance.

6. Able to evaluate, adapt, employ, and manage rapidly emerging technologies in the oil & gas industry.

Application of Knowledge and Skills

7. Capability to evaluate the energy market and key benefits and costs of subsurface fluid extraction and storage developments for local, regional and global communities.

8. Able to think and work individually, apply interpersonal skills in the workplace, and work effectively in multi-disciplinary and multi-cultural teams.

9. Understanding, ongoing commitment and promotion of appropriate professional standards, the highest principles of ethical conduct, and lifelong learning.

Development of Stream Learning Outcomes

Initial development of the Stream Learning Outcomes (SLOs) involved several staff teaching in each of four major petroleum engineering practices in the stream. The draft was then presented to the School Teaching and Learning Committee (TLC) for discussion. This discussion also investigated student and industry feedback and the required amendments were made by TLC, before the draft is presented and approved by petroleum discipline lead and the School Management Committee (SMC). The final SLOs were then resubmitted to the TLC, SMC and IAB in turn for final endorsement.

Curriculum Mapping

Students can select two electives in first year and one elective each in 3rd and 4th year besides two General Education courses. Following curriculum mapping excludes General Education and two elective courses.

For the first-year electives students are recommended to enrol in MINE1010 and GEOS1111, so this have been included in the mapping.

Table 1. Mapping from courses to Stream Learning Outcomes

CO → SLO Mapping	Stream Learning Outcomes (SLOs)								
Courses (CO)	SLO1	SLO2	SLO3	SLO4	SLO5	SLO6	SLO7	SLO8	SLO9
DESN1000	0.0	0.0	0.0	8.3	17.1	9.2	0.0	39.2	26.3
ENGG1811	0.0	0.0	17.8	41.1	41.1	0.0	0.0	0.0	0.0
GEOS1111	16.9	20.2	21.3	20.2	21.3	0.0	0.0	0.0	0.0
MATH1131	8.2	0.0	0.0	78.2	0.0	0.0	8.2	5.4	0.0
MATH1231	9.4	0.0	8.2	68.8	0.0	0.0	8.2	0.0	5.4
MATS1101	0.0	35.8	0.0	28.3	23.3	0.0	0.0	6.2	6.2
MINE1010	41.5	9.8	0.0	0.0	9.8	19.5	0.0	0.0	0.0
PHYS1121	19.0	0.0	5.0	70.0	1.0	5.0	0.0	0.0	0.0
CEIC2001	50.0	0.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0
DESN2000	0.0	7.5	0.0	0.0	8.0	44.5	0.0	30.0	10.0
MATH2018	0.0	0.0	0.0	81.7	0.0	18.3	0.0	0.0	0.0
PTRL2010	37.5	0.0	0.0	0.0	25.0	0.0	12.5	25.0	0.0
PTRL2019	29.2	29.2	29.2	0.0	0.0	12.5	0.0	0.0	0.0
PTRL2020	17.5	17.5	17.5	25.0	17.5	5.0	0.0	0.0	0.0
PTRL2030	12.5	12.5	0.0	45.0	0.0	0.0	0.0	15.0	15.0
PTRL2114	0.0	22.5	35.8	0.0	0.0	20.8	0.0	20.8	0.0
PTRL3001	25.0	4.2	60.4	0.0	0.0	0.0	10.4	0.0	0.0
PTRL3015	0.0	41.7	0.0	0.0	41.7	16.7	0.0	0.0	0.0
PTRL3025	29.2	20.8	0.0	8.3	0.0	16.7	25.0	0.0	0.0
PTRL3030	0.0	0.0	33.3	33.3	0.0	0.0	0.0	16.7	16.7
PTRL3040	36.7	0.0	27.2	18.3	8.9	8.9	0.0	0.0	0.0
PTRL3050	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
PTRL4010	20.0	0.0	0.0	0.0	0.0	20.0	20.0	20.0	20.0
PTRL4011	0.0	0.0	0.0	0.0	0.0	25.0	25.0	25.0	25.0
PTRL4012	16.0	39.0	29.0	8.0	0.0	8.0	0.0	0.0	0.0
PTRL4017	0.0	47.6	47.6	0.0	0.0	4.8	0.0	0.0	0.0
PTRL4020	0.0	33.3	16.7	16.7	16.7	16.7	0.0	0.0	0.0
PTRL4021	0.0	50.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0

Table 2. Mapping from courses to EA Stage 1 Graduate Capabilities

Curriculum Mapping	Engineers Australia Stage 1 Competencies															
Courses (CO)	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	3.5	3.6
DESN1000	-	5.7	-	3.1	4.2	15.0	5.7	-	4.2	3.1	5.3	15.0	8.3	10.9	9.8	9.8
ENGG1811	-	13.7	-	-	20.6	-	13.7	8.9	29.4	-	-	-	-	13.7	-	-
GEOS1111	5.6	7.1	10.1	-	10.1	-	12.8	16.3	30.9	-	-	-	-	7.1	-	-
MATH1131	2.7	4.1	-	-	39.1	1.4	2.7	2.7	39.1	4.1	-	1.4	-	-	1.4	1.4
MATH1231	3.1	4.1	-	-	34.4	1.1	3.1	7.2	38.5	4.1	1.1	1.1	1.1	1.1	-	-
MATS1101	-	7.8	17.9	-	14.2	2.8	7.8	-	32.1	-	1.2	2.8	1.2	9.0	1.6	1.6
MINE1010	13.8	3.2	4.9	6.5	-	-	17.1	13.8	4.9	6.5	-	-	6.5	3.2	-	-
PHYS1121	6.3	0.3	-	1.7	35.0	-	6.7	8.8	37.5	1.7	-	-	1.7	0.3	-	-
CEIC2001	16.7	-	-	-	12.5	-	16.7	29.2	25.0	-	-	-	-	-	-	-
DESN2000	-	2.7	3.8	14.8	-	9.5	2.7	-	3.8	14.8	2.0	9.5	16.8	4.7	7.5	7.5
MATH2018	-	-	-	6.1	40.8	-	-	-	40.8	6.1	-	-	6.1	-	-	-
PTRL2010	12.5	14.6	-	-	-	6.2	20.8	12.5	-	6.2	-	6.2	-	8.3	6.2	6.2
PTRL2019	9.7	-	14.6	4.2	-	-	9.7	24.3	29.2	4.2	-	-	4.2	-	-	-
PTRL2020	5.8	5.8	8.8	1.7	12.5	-	11.7	14.6	30.0	1.7	-	-	1.7	5.8	-	-
PTRL2030	4.2	-	6.2	-	22.5	6.8	4.2	4.2	28.8	-	3.0	6.8	3.0	3.0	3.8	3.8
PTRL2114	-	-	11.2	6.9	-	5.2	-	17.9	29.2	6.9	-	5.2	6.9	-	5.2	5.2
PTRL3001	8.3	5.2	2.1	-	-	-	8.3	38.5	32.3	5.2	-	-	-	-	-	-
PTRL3015	-	13.9	20.8	5.6	-	-	13.9	-	20.8	5.6	-	-	5.6	13.9	-	-
PTRL3025	9.7	12.5	10.4	5.6	4.2	-	9.7	9.7	14.6	18.1	-	-	5.6	-	-	-
PTRL3030	-	-	-	-	16.7	7.5	-	16.7	33.3	-	3.3	7.5	3.3	3.3	4.2	4.2
PTRL3040	12.2	3.0	-	3.0	9.2	-	15.2	25.8	22.8	3.0	-	-	3.0	3.0	-	-
PTRL3050	-	-	25.0	-	-	-	-	25.0	50.0	-	-	-	-	-	-	-
PTRL4010	6.7	10.0	-	6.7	-	9.0	6.7	6.7	-	16.7	4.0	9.0	10.7	4.0	5.0	5.0
PTRL4011	-	12.5	-	8.3	-	11.2	-	-	-	20.8	5.0	11.2	13.3	5.0	6.2	6.2
PTRL4012	5.3	-	19.5	2.7	4.0	-	5.3	19.8	38.0	2.7	-	-	2.7	-	-	-
PTRL4017	-	-	23.8	1.6	-	-	-	23.8	47.6	1.6	-	-	1.6	-	-	-
PTRL4020	-	5.6	16.7	5.6	8.3	-	5.6	8.3	33.3	5.6	-	-	5.6	5.6	-	-
PTRL4021	-	16.7	25.0	-	-	-	16.7	-	25.0	-	-	-	-	16.7	-	-
Cognitive Scale	5.3	5.1	9.0	3.4	11.7	4.5	6.4	10.3	18.7	4.5	2.0	4.5	3.5	4.3	3.3	3.3

Mapping of assessments against courses is presented in Table 3.

Table 3. Mapping courses assessments

CO → AT Mapping	Assessment Types (AT)											
Courses (CO)	Assi	Essa	Exam	Lab	Othe	Perf	Port	Pres	Proj	Repo	Test	Tut
DESN1000	-	5	-	-	20	-	15	15	-	45	-	-
ENGG1811	20	-	70	10	-	-	-	-	-	-	-	-
GEOS1111	-	-	-	-	40	-	-	-	-	20	40	-
MATH1131	10	-	50	-	40	-	-	-	-	-	-	-
MATH1231	10	-	50	-	40	-	-	-	-	-	-	-
MATS1101	-	-	70	30	-	-	-	-	-	-	-	-
MINE1010	-	-	-	-	28	-	-	-	22	50	-	-
PHYS1121	-	-	50	20	30	-	-	-	-	-	-	-
CEIC2001	-	-	100	-	-	-	-	-	-	-	-	-
DESN2000	25	-	-	-	60	-	-	15	-	-	-	-
MATH2018	-	-	60	-	10	-	-	-	-	-	30	-
PTRL2010	-	20	50	-	-	-	-	30	-	-	-	-
PTRL2019	20	-	80	-	-	-	-	-	-	-	-	-
PTRL2020	10	-	65	-	-	-	-	-	-	25	-	-
PTRL2030	40	-	20	-	30	-	-	-	-	-	10	-
PTRL2114	40	-	20	-	30	-	-	-	-	-	10	-
PTRL3001	35	-	50	-	-	-	-	-	-	-	15	-
PTRL3015	16	-	64	20	-	-	-	-	-	-	-	-
PTRL3025	-	-	45	-	-	-	-	-	-	-	55	-
PTRL3030	-	-	40	-	60	-	-	-	-	-	-	-
PTRL3040	-	-	60	-	-	-	-	-	-	-	40	-
PTRL3050	20	-	80	-	-	-	-	-	-	-	-	-
PTRL4010	-	-	-	-	-	-	-	-	100	-	-	-
PTRL4011	-	-	-	-	-	-	-	-	100	-	-	-
PTRL4012	16	10	74	-	-	-	-	-	-	-	-	-
PTRL4017	20	-	60	-	-	-	-	-	-	-	20	-
PTRL4020	-	-	100	-	-	-	-	-	-	-	-	-
PTRL4021	20	-	-	-	-	-	-	15	-	-	65	-

Reflection on Strengths Weaknesses and Future Action

Strengths

The stream offers a comprehensive suite of courses required for raising the next generation of competent petroleum engineers. In particular, a strong fundamental and practical specialist engineering knowledge is transferred to the students in their course of study in the stream. The mapping shows a particular focus on application in the stream. For instance, 2.3 Application of systematic engineering synthesis and design processes - is the highest. The stream covers important parts of industry standard practices such as design, computation, report writing, research, and innovative engineering practices making the students ready to take everyday responsibilities in the industry positions.

Weaknesses

The review of CLOs and SLOs show that the stream has weaknesses in professional engineering practices in particular ethics, health and safety as well as communication skills. While the students can enrol in faculty wide courses covering ethic, health and safety and professional communication skills, the differences between different engineering disciplines and their associated industries demands the stream courses to reflect on these CLOs more comprehensively.

Future Action

The School is in the process of implementing a strategic direction of embedding professional engineering practices and communication skills more generally in the courses in the stream. Particular courses in the stream have been identified where ethics, health and safety and communication skills can be adequately integrated implemented.

Assessment and Academic Integrity

For the technical courses in the stream 50% to 70% of the assessment is in the form of quizzes and exams. The remainder of the assessment is usually in the form of assignments, most commonly in a report format. Thesis and Design courses, revolve around a major work of the thesis or design project, with draft sections of these works assessed as the course progresses to give the students formative feedback. Assessments such as video presentations, interviews and presentation to industry panel are also used to improve student communication skills and increase academic integrity.

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.

Due to COVID all exams have moved online, so standard practices have been adopted including:

- Exams take place at a set time, so that students need to focus on their own exams.

- Questions are Googled before and after the exam. Before ensures the questions are not easy to answer with simple searches. After ensures that the papers have not been uploaded during the exam.
- Wherever practical, more than one set of question papers are prepared to include variability and avoid possible unfair means to attend the online exam.

Summary

A curriculum mapping exercise has been carried out for PETRAH Petroleum Engineering stream of the 3707 Bachelor of Engineering (Honours) program at UNSW. The stream provides good coverage of all the Engineers Australia Stage 1 Graduate Competencies. It is particularly strong in specialist engineering knowledge, the use of design, analysis and computation tools, and design of innovative engineering solutions and systems. Future direction for the stream involves working on embedding professional engineering practices and communication skills more widely throughout the stream. The stream has rigorous and varied assessment tasks, which have been updated and adapted to deal with the advent of COVID-19.

MINEYS Mining Engineering (Postgraduate)

Introduction

This report shows how the MINEYS Mining Engineering stream of the 8621 Master of Engineering program at UNSW fosters the Engineers Australia Level 1 Graduate Competencies in its students. It starts by addressing the overall aims of the stream and its uniqueness. It then covers the stream plan followed by the Stream Learning Outcomes. The process for developing and obtaining feedback to improve these SLOs is detailed. This is followed by the curriculum mapping that relates the individual courses to the Stream Learning Outcomes, the Stream Learning Outcomes to the Graduate Capabilities and the individual courses to the Graduate Capabilities.

Aims of the Stream

The Mining Engineering stream is designed for students with a Bachelor of Engineering degree wanting to enter the engineering profession, enabling them to expand their knowledge and skills in engineering management, acquire an in-depth knowledge of mining engineering specialisation, and gain technical expertise and a basis for international comparability and reciprocal recognition. The stream enables students to specialise, and gain depth of knowledge across a broad range of areas, including project management, mining engineering, geotechnical engineering, risk and safety, and mine geology. The stream is designed to produce AQF level-9 for masters who will have specialised cognitive and technical skills to select and apply methods and technologies to analyse, generate and transmit solutions to complex mining engineering problems.

Stream Plan

Course code	Course name
Core courses	
MINE8101	Fundamentals of Mining Engineering
MINE8115	Mine Processes, Systems and Analysis
MINE8120	Hazard Identification, Risk and Safety Management in Mining
MINE8440	Mining Industry Research Project I
MINE8445	Mining Industry Research Project II
MINE8690	Mining Geotechnical Project
MINE9100	Mining Design Practice
Electives	
MINE5010	Fundamentals of Rock Behaviour for Underground Mining
MINE8130	Technology Management in Mining
MINE8140	Mining Geomechanics
MINE8680	Geotechnical Data Collection and Analysis
MINE8760	Mine Geology and Geophysics for Mining Operations

Stream Learning Outcomes

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

Knowledge

1. Demonstrate knowledge of contextual factors impacting the mining engineering discipline.

2. Demonstrate in-depth as well as broad understanding of the specialist body of knowledge of mining engineering.

3. Discern knowledge development and research directions within the mining engineering discipline.

Skills

4. Engage in effective professional communication.

5. Proficiently apply systematic approaches to carrying out engineering design and projects.

Application of Knowledge and Skills

6. Exhibit a respect for, and understanding of, professional engineering practice in the mining engineering discipline.

7. Demonstrate proficiency in applying engineering techniques, tools, and resources.

8. Apply established engineering methods to complex engineering problem solving.

Development of Stream Learning Outcomes

Initial development of the Stream Learning Outcomes (SLOs) involved the staff teaching the courses in the stream. The draft was then presented to the School Teaching and Learning Committee (TLC) for discussion. This discussion also investigated student and industry feedback and the required amendments were made by TLC before the draft is presented and approved by the mining discipline lead and the School Management Committee (SMC). The final SLOs were then resubmitted to the TLC, SMC and IAC in turn for final endorsement.

Curriculum Mapping

The elective courses used in the mapping extend and complement the core study of mining engineering specialisation and enhance student skills in that field.

Table 1. Mapping from courses to Stream Learning Outcomes

Stream

MINEYS Mining Engineering

Core | Learning Outcomes | Courses | CO → SLO | SLO → GC | Assessment Map | Curriculum Map

CO → SLO Mapping	Stream Learning Outcomes (SLOs)							
Courses (CO)	SLO1	SLO2	SLO3	SLO4	SLO5	SLO6	SLO7	SLO8
MINE5010	11.2	17.5	6.2	0.0	14.2	0.0	36.7	14.2
MINE8101	42.5	14.2	0.0	15.0	0.0	28.3	0.0	0.0
MINE8115	13.5	19.3	6.5	0.0	20.9	6.5	20.9	12.3
MINE8120	12.5	33.3	0.0	8.3	20.8	0.0	8.3	16.7
MINE8130	10.0	10.0	10.0	0.0	10.0	10.0	10.0	0.0
MINE8140	11.2	30.6	5.6	9.2	13.8	9.2	14.8	5.6
MINE8440	0.0	38.0	24.0	0.0	24.0	0.0	14.0	0.0
MINE8445	0.8	0.8	0.8	95.0	0.8	0.0	0.0	1.7
MINE8680	29.4	18.1	0.0	4.4	6.9	4.4	16.2	20.6
MINE8690	8.3	12.5	0.0	25.0	20.8	8.3	16.7	8.3
MINE8760	9.4	27.8	21.5	2.1	7.3	9.4	2.1	20.4
MINE9100	5.3	18.3	18.3	14.0	5.3	10.7	14.0	14.0

Table 2. Mapping from courses to EA Stage 1 Graduate Capabilities

Stream

MINEYS Mining Engineering

Core | Learning Outcomes | Courses | CO → SLO | SLO → GC | Assessment Map | Curriculum Map

Curriculum Mapping	Engineers Australia Stage 1 Competencies															
Courses (CO)	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	3.5	3.6
MINE5010	3.5	3.5	14.8	6.2	3.5	3.5	14.2	19.3	7.1	12.2	-	-	12.2	-	-	-
MINE8101	2.8	2.8	45.3	-	2.8	2.8	-	-	-	-	9.4	7.5	-	9.4	9.4	7.5
MINE8115	3.9	3.9	17.4	6.5	3.9	3.9	12.3	17.4	10.5	7.0	2.2	-	7.0	2.2	2.2	-
MINE8120	6.7	6.7	19.2	-	6.7	6.7	16.7	13.2	10.4	2.8	-	4.2	2.8	-	-	4.2
MINE8130	2.0	2.0	12.0	10.0	2.0	2.0	-	8.3	5.0	3.3	3.3	-	3.3	3.3	3.3	-
MINE8140	6.1	6.1	17.4	5.6	6.1	6.1	5.6	11.8	6.9	4.9	3.1	4.6	4.9	3.1	3.1	4.6
MINE8440	7.6	7.6	7.6	24.0	7.6	7.6	-	16.7	12.0	4.7	-	-	4.7	-	-	-
MINE8445	0.2	0.2	1.0	0.8	0.2	0.2	1.7	0.4	0.4	-	-	47.5	-	-	-	47.5
MINE8680	3.6	3.6	33.0	-	3.6	3.6	20.6	8.9	3.4	5.4	1.5	2.2	5.4	1.5	1.5	2.2
MINE8690	2.5	2.5	10.8	-	2.5	2.5	8.3	16.0	10.4	5.6	2.8	12.5	5.6	2.8	2.8	12.5
MINE8760	5.5	5.5	15.0	21.5	5.5	5.5	20.4	4.4	3.7	0.7	3.1	1.0	0.7	3.1	3.1	1.0
MINE9100	3.7	3.7	9.0	18.3	3.7	3.7	14.0	7.3	2.7	4.7	3.6	7.0	4.7	3.6	3.6	7.0
Cognitive Scale	3.4	3.4	14.4	9.9	3.4	3.4	10.7	9.5	5.6	4.3	3.1	9.2	4.3	3.1	3.1	9.2

Table 3. Mapping courses assessments

Stream

MINEYS Mining Engineering

Core | Learning Outcomes | Courses | CO → SLO | SLO → GC | Assessment Map | Curriculum Map

CO → AT Mapping	Assessment Types (AT)											
Courses (CO)	Assi	Essa	Exam	Lab	Othe	Perf	Port	Pres	Proj	Repo	Test	Tut
MINE5010	100	-	-	-	-	-	-	-	-	-	-	-
MINE8101	-	-	-	-	45	-	-	-	40	15	-	-
MINE8115	-	-	-	-	15	-	-	-	65	20	-	-
MINE8120	-	-	-	-	-	-	-	-	40	-	60	-
MINE8130	-	-	-	-	40	-	-	-	-	60	-	-
MINE8140	-	-	-	-	30	-	-	-	-	70	-	-
MINE8440	-	-	-	-	10	-	-	-	-	90	-	-
MINE8445	-	-	-	-	30	-	-	-	-	65	-	-
MINE8680	-	-	-	-	-	-	-	-	-	100	-	-
MINE8690	-	-	-	-	-	-	-	25	-	75	-	-
MINE8760	-	-	-	-	70	-	-	20	-	-	10	-
MINE9100	-	-	-	-	-	-	-	20	-	80	-	-

Reflection on Strengths Weaknesses and Future Action

Strengths

The stream offers a comprehensive suite of courses required for raising the next generation of competent mining engineers. It is particularly strong in specialist engineering knowledge and the application of engineering techniques. The stream also equips graduates with practical skills and tools in communication, leadership, and research with the mindset to make them ready to take on delegated responsibilities as mining engineers.

Weaknesses

The review of CLOs and SLOs (Tables 1 and 2) shows that the stream has weaknesses in the design, project management, and professional engineering practices in particular ethics, and health and safety. While the students can enrol in faculty wide courses covering ethic, health and safety, the differences between various engineering disciplines and their associated industry procedures and standards demand the courses in the stream to reflect on these CLOs more comprehensively.

Future Action

The School is in the process of implementing a strategic direction of embedding the application of engineering techniques, professional engineering practices, and communication skills more generally in the courses in the stream. Specific courses in the stream have been identified where practices such as communication skills will be adequately implemented thus integrated within the stream.

Assessment and Academic Integrity

For the technical courses in the stream, 15% to 100% of the assessment is in the form of reports and projects. The remainder of the assessment is usually in the form of quizzes and presentations. Additionally, assessment in laboratories occurs in Mineral processing and Mine Geomechanics courses.

Thesis and Design courses, revolve around a major work of the thesis or design project, with draft sections of these works assessed as the course progresses to give the students formative feedback. Assessments such as video presentations, interviews and presentations to industry panels are also used to improve student communication skills and increase academic integrity

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

- Reports are submitted using TurnItIn, which ensures that students are not plagiarising or colluding.
- Academics provide rubrics and 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.

The stream does not involve a mid-term or final exam.

Summary

A curriculum mapping exercise has been carried out for the MINEYS Mining Engineering stream of the 8621 Master of Engineering program at UNSW. The stream provides good coverage of all the Engineers Australia Stage 1 Graduate

Competencies. It is particularly strong in specialist engineering knowledge and the application of engineering techniques and communication skills. Future direction for the stream involves working on embedding professional engineering practices and project management more widely throughout the stream. The stream has rigorous and varied assessment tasks to promote understanding. The stream also offers several research-based courses thus providing the students with a platform to work on the state of the art technologies in the field.

PTRLLS Petroleum Engineering (Postgraduate)

Introduction

This report seeks to develop the links between the PTRLLS Petroleum Engineering stream of the 8621 Master of Engineering program at UNSW and the Engineers Australia Level 1 Graduate Competencies in its students. The report starts by addressing the overall aims of the stream and then covers the stream plan followed by the Stream Learning Outcomes. The process for developing the SLOs is then explained followed by the curriculum mapping that relates the individual courses to the Stream Learning Outcomes, the Stream Learning Outcomes to the Graduate Capabilities and the individual courses to the Graduate Capabilities as well as assessment map.

Aims of the Stream

The Petroleum Engineering stream prepares students to work in oil and gas industry and to learn the methodologies to produce oil and gas from natural reservoirs safely and in an environmentally acceptable way. Students will be able to apply their broad knowledge of engineering to explore the hydrocarbon reservoirs, assess their potential production through production feasibility analysis and use available designs to produce the hydrocarbon efficiently. They also learn the standard industry practice in field development and the elemental design of hydrocarbon production. The stream covers four major engineering practices in petroleum discipline including exploration, drilling, reservoir and production engineering. For entrance into Petroleum Engineering, students are required to already have an undergraduate degree in Petroleum Engineering or a related cognate area. The stream is designed to produce AQF level-9 graduates who will have expert, specialised cognitive and technical skills in a body of knowledge or practice to independently i) analyse critically, reflect on and synthesise complex information, problems, concepts and theories, ii) research and apply established theories to a body of knowledge or practice and iii) interpret and transmit knowledge, skills and ideas to specialist and non-specialist audiences.
Mineral & Mining Engineering is the highest-ranking UNSW subject and third in the world, as per 2022 QS ranking. This is its sixth year in the top 10 and as UNSW's best-performing subject. In addition, petroleum engineering is the first of its kind offering UG and PG petroleum engineering degrees in Australia.

Stream Plan

Course code	Course name

Year 1	
PTRL5009	Well Drilling Equipment and Operation
PTRL5006	Field Development Geology
PTRL5014	Petroleum Geophysics
PTRL5019	Fundamental of Reservoir Engineering A
PTRL9100	Petroleum Design Practice
Elective (Recommended PTRL5100)	Disciplinary Knowledge Elective
Elective (Recommended PTRL5119)	Advanced Disciplinary Knowledge Elective
ETM	Management Elective
Year 2	
MERE9451	Masters Practice Project A
MERE9452	Masters Practice Project B
MERE9453	Masters Practice Project C
Elective (Recommended PTRL5012)	Advanced Disciplinary Knowledge Elective
Elective (Recommended PTRL5021)	Advanced Disciplinary Knowledge Elective
Elective	Advanced Disciplinary Knowledge Elective
Elective	Advanced Disciplinary Knowledge Elective
Elective	Disciplinary Knowledge Elective
Elective	Management Elective
Industrial Training	Industrial Training

Stream Learning Outcomes

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

Knowledge

1. Proficiently apply systematic approaches to carrying out engineering design and projects

2. Discern knowledge development and research directions within the petroleum engineering discipline

3. Demonstrate knowledge of contextual factors impacting the petroleum engineering discipline

Skills

4. Exhibit a respect for, and understanding of, professional engineering practice in the petroleum engineering discipline

5. Apply established engineering methods to complex engineering problem solving

Application of Knowledge and Skills

6. Demonstrate proficiency in applying engineering techniques, tools, and resources

7. Engage in effective professional communication

8. Demonstrate in-depth as well as broad understanding of the specialist body of knowledge of petroleum engineering

Development of Stream Learning Outcomes

Initial development of the Stream Learning Outcomes (SLOs) involved several staff teaching in each of four major petroleum engineering practices in the stream. The draft was then presented to the School Teaching and Learning Committee (TLC) for discussion. This discussion also investigated student and industry feedback and the required amendments were made by TLC, before the draft is presented and discussed with petroleum discipline lead and the School Management Committee (SMC). The final SLOs were then resubmitted to the TLC, SMC and IAB in turn for final endorsement.

Curriculum Mapping

To determine the electives to use in the mapping, the electives representing the transformation in the industry toward more sustainable energy production in each category of the discipline were determined and used (e.g. Geothermal Engineering).

Table 1. Mapping from courses to Stream Learning Outcomes

Stream

PTRLLS Petroleum Engineering

Core | Learning Outcomes | Courses | CO → SLO | SLO → GC | Assessment Map | Curriculum Map

CO → SLO Mapping	Stream Learning Outcomes (SLOs)							
Courses (CO)	SLO1	SLO2	SLO3	SLO4	SLO5	SLO6	SLO7	SLO8
PTRL5006	6.7	35.0	10.8	11.7	6.7	6.7	11.7	10.8
PTRL5009	19.4	16.7	19.4	0.0	8.3	19.4	0.0	16.7
PTRL5012	23.3	5.0	21.7	0.0	4.0	13.7	5.0	27.3
PTRL5014	20.6	6.9	20.6	8.8	6.9	20.6	8.8	6.9
PTRL5019	17.5	20.8	17.5	5.8	5.8	5.8	15.0	11.7
PTRL5021	16.7	8.3	19.4	0.0	19.4	19.4	0.0	16.7
PTRL5100	16.7	27.8	27.8	0.0	11.1	0.0	0.0	16.7
PTRL5119	33.3	25.0	8.3	0.0	8.3	8.3	0.0	16.7
MERE9451	22.2	11.1	27.8	0.0	11.1	11.1	16.7	0.0
MERE9452	22.2	11.1	27.8	0.0	11.1	11.1	16.7	0.0
MERE9453	22.2	11.1	27.8	0.0	11.1	11.1	16.7	0.0
PTRL9100	7.2	9.7	10.5	11.2	10.5	9.7	34.0	7.2

Table 2. Mapping from courses to EA Stage 1 Graduate Capabilities

Stream

PTRLLS Petroleum Engineering

Core | Learning Outcomes | Courses | CO → SLO | SLO → GC | Assessment Map | Curriculum Map

Curriculum Mapping	Engineers Australia Stage 1 Competencies															
Courses (CO)	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	3.5	3.6
PTRL5006	2.9	2.7	5.6	15.9	3.8	3.0	4.0	2.7	5.7	2.8	5.0	6.2	13.3	14.0	6.2	6.2
PTRL5009	6.3	3.8	11.1	12.8	6.2	8.7	7.7	3.8	12.5	6.2	4.9	-	10.4	5.6	-	-
PTRL5012	6.6	4.6	12.1	11.0	6.1	8.6	7.3	4.6	13.1	6.5	5.4	1.7	7.5	1.7	1.7	1.7
PTRL5014	5.1	2.1	10.3	8.4	6.3	9.3	6.3	2.1	11.4	6.3	6.9	4.7	7.4	4.0	4.7	4.7
PTRL5019	2.8	2.6	7.2	13.0	5.3	5.5	3.8	2.6	8.2	5.3	5.5	6.2	11.3	8.1	6.2	6.2
PTRL5021	6.3	5.6	11.1	10.0	8.1	8.1	9.5	5.6	13.7	7.4	4.9	-	6.9	2.8	-	-
PTRL5100	2.4	4.2	9.3	18.6	8.8	4.2	4.2	4.2	8.4	6.0	6.9	-	13.4	9.3	-	-
PTRL5119	4.0	3.8	6.1	12.8	3.5	10.0	5.4	3.8	13.8	9.7	2.1	-	16.7	8.3	-	-
MERE9451	2.2	1.9	9.2	10.6	8.8	7.8	4.1	1.9	9.6	7.4	6.9	5.6	9.3	3.7	5.6	5.6
MERE9452	2.2	1.9	9.2	10.6	8.8	7.8	4.1	1.9	9.6	7.4	6.9	5.6	9.3	3.7	5.6	5.6
MERE9453	2.2	1.9	9.2	10.6	8.8	7.8	4.1	1.9	9.6	7.4	6.9	5.6	9.3	3.7	5.6	5.6
PTRL9100	3.0	2.8	5.6	6.9	4.4	3.7	4.7	2.8	6.5	3.5	4.9	13.6	5.0	5.5	13.6	13.6
Cognitive Scale	3.6	2.9	8.3	11.1	6.2	6.6	5.1	2.9	9.6	5.9	5.3	5.7	9.4	5.6	5.7	5.7

Table 3. Mapping courses assessments

Stream

PTRLLS Petroleum Engineering

Core | Learning Outcomes | Courses | CO → SLO | SLO → GC | Assessment Map | Curriculum Map

CO → AT Mapping	Assessment Types (AT)											
Courses (CO)	Assi	Essa	Exam	Lab	Othe	Perf	Port	Pres	Proj	Repo	Test	Tut
PTRL5006	40	-	20	-	30	-	-	-	-	-	10	-
PTRL5009	-	-	55	10	-	-	-	-	35	-	-	-
PTRL5012	16	-	50	-	-	-	-	10	-	-	24	-
PTRL5014	-	-	20	-	70	-	-	-	-	-	10	-
PTRL5019	-	-	70	-	-	-	-	-	30	-	-	-
PTRL5021	10	-	40	-	-	-	-	-	-	40	10	-
PTRL5100	-	-	-	-	-	-	-	50	-	50	-	-
PTRL5119	-	-	50	-	-	-	-	-	-	-	50	-
MERE9451	-	-	-	-	-	-	-	-	100	-	-	-
MERE9452	-	-	-	-	-	-	-	-	100	-	-	-
MERE9453	-	-	-	-	-	-	-	-	100	-	-	-
PTRL9100	-	-	-	-	-	-	-	-	-	100	-	-

Reflection on Strengths Weaknesses and Future Action

Strengths

The stream offers a comprehensive suite of courses required for raising the next generation of competent petroleum engineers. In particular, the graduates develop a deep knowledge and research directions in the discipline. The stream also covers important parts of industry standard practices in particular design processes and application of systematic engineering synthesis. An important strength of the stream is to raise creative and innovative engineers who are pro-active demeanour with self-initiated behaviour that endeavours to solve a problem before it has occurred.

Weaknesses

The review of the curriculum map shows that the stream has weaknesses in i) effective oral and written communication in professional and lay domains and ii) orderly management of self, and professional conduct and iii) effective team membership and team leadership. While the students can enrol in faculty wide courses covering professional communication skills and professional conduct as electives, the effective team membership and leadership within the specific discipline (petroleum engineering herein) needs to be implemented in the relevant courses in the stream.

Future Action

The School is in the process of implementing a strategic direction of embedding professional engineering practices and communication skills more generally in the courses in the stream. Specific courses in the stream have been identified where practices such as communication skills will be adequately implemented thus integrated within the stream.

Assessment and Academic Integrity

For the technical courses in the stream around 50% of the assessment is in the form of quizzes and exams (Table 3). The remainder of the assessment is usually in the form of projects, most commonly in a report format. Some of technical and other non-technical courses revolve around major research projects, with draft sections of these works assessed as the course progresses to give the students formative feedback and also transfer the knowledge to students in research methodologies and procedures.

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

- Reports are submitted using TurnItIn, which ensures that students are not plagiarising or colluding.
- Academics provide rubrics and 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.
- All exam papers are reviewed by the academic after markers.
- Important works, such as thesis, will have two markers to ensure consistency.

Due to COVID all exams have moved online, so standard practices have been adopted including:

- The questions pool was encouraged and implemented by several academics. This method produces random questions from the pool to the students reducing the chance of misadventure and academic integrity issues.

- Special interpretive questions were designed and used in some courses which considerably reduced the issues with academic integrity.
- Exams take place at a set time, so that students need to focus on their own exams.
- The existence of any questions on online platforms is regularly check by course conveyors.

Summary

A curriculum mapping exercise has been carried out for PTRLLS Petroleum Engineering stream of the 8621 Master of Engineering program at UNSW. The stream provides good coverage of all the Engineers Australia Stage 1 Graduate Competencies. It is particularly strong in specialist engineering knowledge, the use of design, analysis and computational tools, and design of innovative engineering solutions and systems. Future direction for the stream involves working on embedding professional engineering practices and communication skills more widely throughout the stream. The stream has rigorous and varied assessment tasks, which have been updated and adapted to deal with the advent of COVID-19. The stream also offers several research-based courses thus providing the students with a platform to work on the state of the art technologies in the field.