

ELEC4953

Research Thesis C

Term 2, 2022



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Aron Michael	a.michael@unsw.edu.au	Monday 4:00pm-4:30pm	G17, 316	02 93855663

School Contact Information

Consultations: Lecturer consultation times will be advised during the first lecture. You are welcome to email the tutor or laboratory demonstrator, who can answer your questions on this course and can also provide you with consultation times. ALL email enquiries should be made from your student email address with ELEC/TELExxxx in the subject line; otherwise, they will not be answered.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle <https://moodle.telt.unsw.edu.au/login/index.php>. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Student Support Enquiries

[For enrolment and progression enquiries please contact Student Services](#)

Web

[Electrical Engineering Homepage](#)

[Engineering Student Support Services](#)

[Engineering Industrial Training](#)

[UNSW Study Abroad and Exchange](#) (for inbound students)

[UNSW Future Students](#)

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Email

[Engineering Student Support Services](#) – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

Course Details

Units of Credit 4

Summary of the Course

Contact Hours

The course consists of regular online meetings with the supervisor, typically about 30 minutes weekly. In addition, the Project usually involves experimental work and thus requires laboratory assistance from the supervisor and/or technical staff.

Context

This course is normally undertaken in the last semester of the BE degree program. Its purpose is for students to undertake directed laboratory and research work on an approved topic under the guidance of an academic supervisor.

Course Aims

The thesis provides an opportunity for the student to bring together engineering principles learned over their previous years of study and apply these principles to innovatively solve problems such as the development of a specific design, process and/or the investigation of a hypothesis. Thesis projects must be complex, open-ended problems that allow room for student creativity, and the acquisition, analysis and interpretation of results. There must be multiple possible solutions or conclusions at the outset and sufficient complexity to require a degree of project planning from the student. The thesis requires the student to formulate problems in engineering terms, manage an engineering project and find solutions by applying engineering methods. Students also develop their ability to work in a research and development environment.

The course provides a great introduction to work in industry and research, and serves as an important indicator of how well students are able to utilize and integrate the knowledge and skills they have learnt throughout their program.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Develop a design or a process or investigate a hypothesis following industry and professional engineering standards.	PE1.2, PE1.3, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.3, PE3.6
2. Critically reflect on a specialist body of knowledge related to their thesis topic.	PE1.3, PE1.4, PE3.1, PE3.2
3. Apply scientific and engineering methods to solve an engineering problem.	PE1.2, PE1.3, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4,

Learning Outcome	EA Stage 1 Competencies
	PE3.3
4. Analyse data objectively using quantitative and mathematical methods.	PE1.2, PE1.3, PE2.1, PE2.2
5. Demonstrate oral and written communication in professional and lay domains.	PE3.1, PE3.2, PE3.3, PE3.4, PE3.5, PE3.6

Teaching Strategies

The course is taught as an individual research project, to develop a level of research skills and autonomy.

Delivery Mode

- One introduction lecture by the course coordinator – to explain Project requirements, procedures, available resources, and assessment scheme.
- Regular weekly online meetings between supervisor and student – to discuss and advise on the Project work.
- Laboratory access throughout the semester – for students to carry out practical design and development work with occasional assistance from technical staff.

Learning in this course

The Research Thesis gives you the opportunity to take on a project on your own, to produce a self-contained and rounded piece of work and write it up for others to assess and use. While the project is yours alone, you will need to obtain advice, information and assistance from others, for example your supervisor, technical officers responsible for laboratories, or computing and workshop staff.

Regular online meetings with your supervisor are important, especially during the early stages when it is important to check that what you are doing is indeed what is required. If you want to contact your supervisor outside a regular online meeting time, leave a message arranging a time to meet. Prearranged consultations are often more effective, check contact details on the School website.

Having completed Research Thesis A and B, at this stage you should have a clear idea what you are going to do and what tasks have got to be performed on the way to achieving your goal.

It is a good idea to draw up a developmental schedule and allocate times for each task and important stages or project milestones. The time duration of each task should be carefully checked to ensure it is realistic and, in particular, allows sufficient time for tasks that are critical for the success of the project. For example, ordering components or equipment construction by the workshop, access to state-of-the-art research facilities may have particularly time implications you need to be well aware of. There may be significant lead time with component delivery. Workshop time is always limited and long delays are frequently experienced and therefore it is important to get drawings to the workshop as soon as possible. Access to research facility often requires laboratory inductions and extensive training. Discuss these issues with your supervisor to draw up realistic and time efficient plan.

You are expected to complete your Project work at the end of the term, prepare an Online Open Day demonstration and submit your Research Thesis Report. It is wise to keep all these milestones in

mind as you work to bring your chosen topic to fruition.

Keep careful notes and write up as you go. The importance of keeping good notes is understood by all of us who have been frustrated by losing an important reference or vital information about an experiment. Careful note taking can also simplify the final Research Thesis Report write-up.

Start writing-up as soon as possible - Day 1 is not too early. This is good advice because writing-up often helps to clarify ideas and can suggest some additional investigations to pursue. It is better to make this kind of discovery early rather than later. Furthermore, writing-up is a major task that should not be rushed.

Try to have your draft complete well before submission date and discuss it with your supervisor before producing the final version. Transforming the draft into the final version requires considerable organisation. Allow at least a week for the normal contingencies (e.g. proof reading and the correction of typing errors), and for other problems (e.g. failed equipment). Equipment breakdown is not a valid excuse for late submission

Additional Course Information

Credits

This is a 4 UOC, level 4 course. The expected workload is 10 hours per week throughout the 10-week term. It is important to note that the weighting applied to the course is equivalent to 8.7 UOC from the available overall 12 UOC for the Project course.

Relationship to Other Courses

This is a fourth-year core course for students following a BE (Electrical or Telecommunications or Quantum) program in the EE&T School and other combined degree programs. This course constitutes the third part of the three-part Research Thesis work (parts A, B and C). It follows Research Thesis B, which involves completion of preliminary works (familiarisation with tools or equipment required for the project), refined solution, formulation of detailed research plan, and producing initial results of the detailed design and developmental work. In this course, the student will continue with the detailed design and developmental work and demonstrate the complete design or process or the result of investigated hypothesis.

Pre-requisites and Assumed Knowledge

The pre-requisite for this course is ELEC9452 which must have been completed in the immediate preceding term. ELEC9452 can also be a co-requisite course for students doing Research Thesis B and C together.

Following Courses

There are no following courses.

Assessment

Assessment is based on evaluating the student's work through the final report (86%) and the Online Open Day presentation (14% weighting).

The breakdowns for marking the report are as follows: (i) literature review/background (10%); (ii) execution of the research project, quality of analysis, discussion of results (50%); (iii) conclusions and value added (20%); and document presentation (20%).

The marking of the Online Open Day presentation is based on the quality of the Project poster, viva voice, and demonstration of the project work.

The assessment of the report and Online Open Day presentation will be carried out by the Project supervisor and the assessor whose marks are equally weighed. The assessor is an academic staff assigned by the School. The marking is done independently by each marker, without collusion or knowledge of the other mark.

The final Project report is to be submitted by **12pm (noon) Thursday week 10 of the term**. This is done by uploading the report via Moodle as a pdf formatted file. The Project report must be individually written even for cases where a group of students work on the same topic. If your supervisor or assessor specifically requests a printed copy of your report, please make one and hand it to them directly (but you still also need to upload your report).

The student must attend and exhibit his/her Project work at the Online Open Day held in the School on the **Friday week 9 of the term**. The exact time and place for the Online Open Day will be announced by e-mail and on Moodle later in the term.

Policy for lateness

The penalty is detailed below:

- For Online Open Day presentation – zero (0) mark is awarded
- For Project report – 5 marks off the *Project* for every day late. Penalty applies until the marks for the *course* decrease to 50, and further lateness does not result in failure of the *course*, but might be a failure of the Project report (weekends count as days). Any Project report not turned in within 6 weeks after the deadline will be finalised at zero (0) marks.

In all cases, applications for late submission can be applied for BEFORE the due date. This is at the discretion of the Project coordinator but should only be granted in exceptional circumstances beyond the student's control. As per normal, students can also apply through myUNSW for special consideration.

Discrepancy amongst Project marks

The Online Open Day presentation mark is the unweighted average of the two marks. About the report mark:

- For mark difference less than or equal to 10 marks, the unweighted average is used.

- For mark difference of 11-15 marks, the Project Coordinator discusses with the two markers about why they gave their marks and assists the two markers to come to an agreement on a final mark.
- For any mark difference greater than 15 marks, a third assessor is used. An unweighted average of the three marks will be used.
- If the situation arises that one mark is invalid, the Project Coordinator has the discretion to eliminate that mark and average the other two (if they fall within the 10-mark difference)

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Thesis report	85%	04/08/2022 12:00 PM	1, 2, 3, 4, 5
2. Poster presentation	15%	28/07/2022 05:00 PM	1, 2, 3, 4, 5

Assessment 1: Thesis report

Submission notes: This assignment is submitted through Turnitin and students can see Turnitin similarity reports. Once the Turnitin similarity is below the acceptable 15%, the report is to be uploaded using "PART C REPORT ASSESSMENT" workshop tools for marking.

Due date: 04/08/2022 12:00 PM

A final report must be produced. The report covers literature review/background, execution of the research project, quality of analysis and discussion of results and conclusions.

The final thesis report is to be submitted by 12pm (noon) Thursday week 10 of the term. This is done by uploading the report via Moodle as a pdf formatted file. The report must be individually written even for cases where a group of students work on the same topic. If your supervisor or assessor specifically requests a printed copy of your report, please make one and hand it to them directly (but you still also need to upload your report).

This assignment is submitted through Turnitin and students can see Turnitin similarity reports

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Assessment criteria

The assessment is based on 4 criteria: literature review/background and putting the results in context (10%); execution of the project, quality of analysis, discussion of results (50%); conclusions and value added (20%); and document presentation (20%).

Additional details

Literature review/background and putting the results in context:

Literature review (comprehensive, up-to-date, critical assessment of existing work), problem statement, hypothesis and aims.

Marking guide:

0-49: Aims not clear

50-64: Reason for research not clear

65-74: Background clear - results not contextualized

75-84: Background and aims are clear, context is incomplete

85-100: Background to research and significance of conclusions reached are clear

Execution of the project, quality of analysis, discussion of results:

Systematic approach to the work, logical thinking in gathering information, analyzing available information, formulating plans and solutions; level of underlying conceptual difficulty or complexity of the problem faced; level of workmanship or clever traits in modelling, design, experiment and testing solution to problem; attention to details, take care in getting results; results appear to be correct, meaningful; critical analysis and interpretation of results; self-criticism or reflection on the reliability or limitations of results.

Marking guide:

0-49: Clearly deficient

50-64: Superficial results, lacking intellectual engagement

65-74: Several components to the research work not coherently linked

75-84: Solid and coherent work, linking all the research components together into a consistent story

85-100: Solid, compelling, coherent and consistent story PLUS something unexpected

Conclusions and value added:

Quality of conclusions (relationship to content, merit as summary); any new discovery, creative thought, publications?

Marking guide:

0-49: No technical value

50-64: No interesting results

65-74: Minimal value

75-84: Will have wider impact when further work is done

85-100: Will have wider impact now

Assessment 2: Poster presentation

Submission notes: Submit the electronic version of the poster on Moodle before 28/07/2022 5:00pm using "Part C Presentation Assessment" workshop tool.

Due date: 28/07/2022 05:00 PM

The student must attend and exhibit his/her Project work at the Online Open Day held in the School on the Friday week 9 of the term. The exact time and place for the Online Open Day will be announced by email and on Moodle later in the term. The Online Open Day presentation will be assessed by the thesis supervisor and the assessor whose marks are equally weighed. The assessor is an academic staff assigned by the School. The marking is done independently by each marker, without collusion or knowledge of the other mark.

Assessment criteria

The assessment is based on 5 criteria of equal weighting: rationale, content, demonstration, communication and question handling

Additional details

RATIONALE:

Has the student been able to explain why the work was done?

Marking guide:

0-49: The student cannot explain why the work was done

50-64: The student attempts to explain why the work was done but you think they barely understand

65-74: Good, above satisfactory effort

75-84: The student is able to explain why the work was done in direct terms.

85-100: The student is able to explain the broader context that the work fits into, why it was done and how important it is

CONTENT:

How good is the work? Extent of applications of engineering methods?

Marking guide:

0-49: Work completely fails to address the stated aims,

50-64: Work is trivial or was conducted incorrectly or with inappropriate use of engineering methods, placing conclusions in some doubt

65-74: Engineering methods were employed correctly in project, but with some weaknesses or omissions in the methods employed

75-84: Project professionally conducted using appropriate engineering methods

85-100: Quite challenging project conducted which required extensive use of high-level engineering methods

DEMONSTRATION:

Does it work? What new information was learned?

Marking guide:

0-49: Deficient, no tangible deliverable, not much to show, nothing learned

50-64: Satisfactory, maybe inconclusive but evidence of serious effort

65-74: Good show from which some credible conclusions can be drawn

75-84: Very good, professionally performed

85-100: Excellent, very convincing demonstration of a non-trivial project with valuable new results

COMMUNICATION:

How well is the work presented?

Marking guide:

0-49: Taken together, graphical and verbal dissemination of findings is so poor that you are left unsure what the work is about

50-64: Some deficiencies: more than one of aims, methods, results and conclusions are not clear.

65-74: Aims, methods, results and conclusions are clear but only after probing. Some aspects of the poster or presentation were not well considered.

75-84: Aims, methods, results, conclusions are all clear. The poster is adequate.

85-100: Aims, methods, results, conclusions are all clear. The poster is excellent and attractive; the presentation is engaging

Q&A:

How well is the student able to answer questions?

Marking guide:

0-49: Unable to answer questions about the work or attempt to answer but clearly doesn't really understand

50-64: Able to answer questions but there are flaws. Nevertheless, you are fairly sure they understand what they're doing

65-74: Able to answer questions with only minor flaws; you are sure they have reasonably good

understanding about their work

75-84: Able to answer questions easily and directly, almost flawless

85-100: Provide in-depth flawless answers that demonstrate commanding knowledge of the subject matter

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

Period	Activity
Weeks 1-5	<ul style="list-style-type: none"> ▪ Provide Thesis/Project details for each assessment via Moodle course page 'ELEC9453/4953 Research Thesis C/Masters Project C 2022 T1' <ul style="list-style-type: none"> ◦ Provide thesis/project topic, your name and supervisor's name. ◦ The details should be provided for each assessment. In this course, the assessments are POSTER PRESENTATION ASSESSMENT and PART C REPORT ASSESSMENT. ◦ To provide the details for POSTER PRESENTATION ASSESSMENT, follow the steps below <ul style="list-style-type: none"> ▪ Go to Poster Open Day (click to expand the section) ▪ Click on POSTER PRESENTATION ASSESSMENT and follow the prompt ◦ To provide the details for PART C REPORT ASSESSMENT, follow the steps below <ul style="list-style-type: none"> ▪ Go to Project C Report (click to expand the section) ▪ Click on PART C REPORT ASSESSMENT and follow the prompt
Weeks 1-10	<ul style="list-style-type: none"> ▪ Weekly online meetings during the semester with supervisor for technical guidance on Project work ▪ Laboratory work during the semester subject to arrangement with technical staff
Week 9	<ul style="list-style-type: none"> ▪ Friday: Online Open Day, Time TBA. Activities: Project poster presentation, viva voce, demonstration of Project
Week 10	<ul style="list-style-type: none"> ▪ 12pm Thursday: deadline for submission of Final Report, submit online via Moodle

[View class timetable](#)

Timetable

Date	Type	Content
Week 9: 25 July - 29 July	Assessment	Poster presentation: Submit the electronic version of the poster on Moodle before 28/07/2022 5:00pm using "Part C Presentation Assessment" workshop tool.
Week 10: 1 August - 5 August	Assessment	Thesis report: This assignment is submitted through Turnitin and students can see Turnitin similarity reports. Once the Turnitin similarity is below the acceptable 15%, the report is to be uploaded using "PART C REPORT ASSESSMENT" workshop tools for marking.

Resources

Prescribed Resources

Recommended text(s):

Reading materials are specified by the supervisor (related to particular Project topic).

On-line resources

Moodle

As a part of the teaching component, Moodle will be used to disseminate materials, host forums: <https://moodle.telt.unsw.edu.au/login/index.php>. All information about this course is available from this link which is regularly updated.

Mailing list

Announcements concerning course information will be given on Moodle and/or via email (which will be sent to your student email address).

ADDITIONAL INFORMATION ABOUT THE PROJECT

Project Report Specification

- The report must be submitted as **one single pdf file**.
- Page size must be A4 (210 x 297 mm). Page margins must not be less than: 25mm (left and right edges), 25mm (upper edge), and 20mm (lower edge).
- Project must be prepared using a word processor, e.g Microsoft Office.
- The report must include a **title page** headed:

THE UNIVERSITY OF NEW SOUTH WALES

SCHOOL OF ELECTRICAL ENGINEERING AND TELECOMMUNICATIONS

Title of Project

Name of Author

Bachelor of Engineering (or other degree for which the Project is submitted)

Submission Date (month and year)

Supervisor: (followed by name)

- Immediately following the title page is the Project **summary page**. This summary sheet is designed to assist in determining the overall input by students into the Project work. The guidelines for completing the summary page and the summary form can be downloaded from the course website. Complete this form, sign and date it, scan the form, and insert into the Project report as the second page (after the title page).
- Students might like to include a page for acknowledgment. This would be the third page.
- All pages must be numbered. The main body of the Project must be numbered consecutively from beginning to end. Other sections must either be included or have their own logical numbering system.
- Graphs, diagrams and photographs should be inserted as close as possible to their first reference in the text. Rotated graphs etc are to be arranged so as to be conveniently read, with the bottom edge to the outside of the page.
- The author of the Project is responsible for the preparation of the Project before the deadline, proofreading the typescript and having corrections made as necessary.

Research Thesis Online Open Day

At the end of the course students are required to demonstrate their Project work and to answer questions from staff and students. It is compulsory for all students including those with topics of a theoretical nature to be present on the Research Thesis Online Open Day.

The Research Thesis Online Open Day is scheduled on the **Friday week 9 of the term** and demonstrations are normally carried out in the School laboratories. You should prepare a **poster** with appropriate diagrams and extracts from your Project to help in the explanation of the overall project as well as giving suitable demonstrations of particular aspects of your achievements. The template for the poster and some examples of work by previous students are available on the course website. You have to make your own arrangement for poster printing through facilities available on or off-campus. When planning your Online Open Day presentation remember that, in addition to your assessors and other School academics, many visitors will be junior students seeking information to help them choose their own Project topic.

If Things Go Wrong

If you start having serious problems, don't ignore them or stop working; the problems won't go away. Talk over your worries with your supervisor to see what you can do to get going again. If you are still not able to resolve the problems, then see the Project Coordinator, the Director of Academic Studies in EE&T or the Student Counseling and Careers Unit. The Learning Centre also offers advice and support on these matters. Often some advice or perhaps reducing the scope of the project can get you working effectively for the rest of the year.

Academic Honesty and Plagiarism

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see <https://student.unsw.edu.au/plagiarism>. To find out if you understand plagiarism correctly, try this short quiz: <https://student.unsw.edu.au/plagiarism-quiz>.

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Academic Information

COVID19 - Important Health Related Notice

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by [NSW health](#) or government authorities. Current alerts and a list of hotspots can be found [here](#). **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate.** We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed.

If you are required to self-isolate and/or need emotional or financial support, please contact the [Nucleus: Student Hub](#). If you are unable to complete an assessment, or attend a class with an attendance or participation requirement, please let your teacher know and apply for [special consideration](#) through the [Special Consideration portal](#). To advise the University of a positive COVID-19 test result or if you suspect you have COVID-19 and are being tested, please fill in this [form](#).

UNSW requires all staff and students to follow NSW Health advice. Any failure to act in accordance with that advice may amount to a breach of the Student Code of Conduct. Please refer to the [Safe Return to Campus](#) guide for students for more information on safe practices.

Dates to note

Important Dates available at: <https://student.unsw.edu.au/dates>

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see <https://student.unsw.edu.au/policy>), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both formal classes and *independent, self-directed study*. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

[You must submit all assignments and attend all examinations scheduled for your course.](#) You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application **prior to the start** of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. Be aware of the “fit to sit/submit” rule which means that if you sit an exam or submit an assignment, you are declaring yourself well enough to do so and cannot later apply for Special Consideration. For more information and how to apply, see <https://student.unsw.edu.au/special-consideration>.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies:

<https://student.unsw.edu.au/guide>

<https://www.engineering.unsw.edu.au/electrical-engineering/resources>

Disclaimer

This Course Outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies:

Image Credit

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	✓
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	✓
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	✓
PE3.5 Orderly management of self, and professional conduct	✓
PE3.6 Effective team membership and team leadership	✓