



School of Electrical Engineering and Telecommunications

Term 1, 2021  
Course Outline

## ELEC9452 Masters Project B

### COURSE STAFF

Project supervisor: To be nominated by the student (together with thesis topic)  
Project coordinator: Dr. Aron Michael, [a.michael@unsw.edu.au](mailto:a.michael@unsw.edu.au)

**Consultations:** About the Project work, technical inquiries should be directed to the Project supervisor whereas general administrative inquiries should be directed to the Project coordinator. All email enquiries should be made from your student email address with ELEC9452 in the subject line; otherwise they will not be answered.

**Keeping Informed:** Announcements may be made 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. The Moodle name of this course is: **ELEC 4952/9452 Research Thesis B/Masters Project B 2021 T1**.

### COURSE SUMMARY

#### Contact Hours

The Project 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 and Aims

This course is normally undertaken in the second term of the last year of the ME (BE-ME) 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.

The Project 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 provide 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 which requires a high degree of project planning from the student. The Project requires students to formulate problems in engineering terms, manage engineering projects and find solutions by applying engineering methods. Students also develop skills to work in a research and developmental environment

The Project provides a good 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.

## Schedules

Period	Activity
	<ul style="list-style-type: none"> <li>▪ Student will continue working on the same Project topic as in Project A with the same supervisor</li> <li>▪ Weekly online meetings during the term with supervisor for technical guidance on Project work</li> <li>▪ Laboratory work during the term subject to arrangement with technical staff</li> </ul>
Week 1	<ul style="list-style-type: none"> <li>▪ Online meeting with supervisor to discuss plan and update progress</li> </ul>
Week 1-4 (Week 1-2)*	<ul style="list-style-type: none"> <li>▪ Provide Project details for each assessment via Moodle course page 'ELEC4952/9452 Research Thesis B/Masters Project B 2021 T1' <ul style="list-style-type: none"> <li>○ For start, provide general Project topic, your name and supervisor's name. Project topic has already been finalised in Project A.</li> <li>○ The details should be provided for each assessment. In this course, the assessments are PART B REPORT ASSESSMENT and PART B PARTICIPATION EFFORT</li> <li>○ To provide the details for PART B REPORT ASSESSMENT, follow the steps below <ul style="list-style-type: none"> <li>▪ Go to Project B REPORT (click to expand the section)</li> <li>▪ Click on PART B REPORT ASSESSMENT and follow the prompt</li> </ul> </li> <li>○ To provide the details for PART B PARTICIPATION EFFORT, follow the steps below <ul style="list-style-type: none"> <li>▪ Go to Project B Report (click to expand the section)</li> <li>▪ Click on PART B PARTICIPATION EFFORT and follow the prompt</li> </ul> </li> </ul> </li> </ul>
Week 5 (Week 3) *	<ul style="list-style-type: none"> <li>▪ Submit progress report by Thursday 12pm – March 15, 2020 (March 1, 2021) *</li> </ul>
Week 6-10	<ul style="list-style-type: none"> <li>▪ Meet with supervisor and keep a meeting log sheet</li> </ul>
Week 10	<ul style="list-style-type: none"> <li>▪ Submit a three-page executive summary and a meeting log sheet by Thursday 5pm – April 19, 2021. <b>The executive summary is a condensation of the whole thesis to date (part A and B).</b> To submit, follow the steps below <ul style="list-style-type: none"> <li>▪ Go to Project B Report (click to expand the section)</li> <li>▪ Click on PART B PARTICIPATION EFFORT and follow the prompt</li> </ul> </li> </ul>

\*for those doing B and C together

## Assessments

1. Progress report                    50% weighting
2. Participation effort                50% weighting

## 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.

## COURSE DETAILS

### Credits

This is a 4 UOC, level 4 course. It is important to note that in the WAM (Weighted Average Mark) calculation for awarding Honours degree, the weighting applied makes it equivalent to 1.2 UOC, level 4. The expected workload is 10 hours per week throughout the 10-week term.

### Relationship to Other Courses

This is a postgraduate core course for students following a ME or BE ME in Electrical or Telecommunications program in the EE&T School and other combined degree programs. This course constitutes the second part (Project B) of the three-part project work (Project A, B and C). It involves completing preliminary work, producing initial results from the execution of the main task, acquiring high level of skills in using software and hardware (tools or equipment) relevant to the project, and revising research plan in the context of preliminary work. This prepares the student for the detailed project work that will be undertaken in Project C in the following subsequent term.

### Pre-requisites and Assumed knowledge

The pre-requisite for this course is ELEC9451.

### Following Courses

The course can be a pre-requisite or a co-requisite for ELEC9453. When it is a pre-requisite, ELEC9453 must be taken in the immediate following term. When it is also a co-requisite, ELEC9453 will be taken in the same term.

### Learning outcomes

At the conclusion of this course, students should be able to:

1. Develop a design or a process or investigate a hypothesis following industry and professional engineering standards.
2. Critically reflect and acquire the required skills on the chosen topic area as the basis for demonstrating a clear understanding of the engineering problem that they are trying to solve and thus developing their own design or process as a possible solution to the problem.
3. Apply scientific and engineering methods to solve an engineering problem. Complete preliminary work, propose solution, and produce initial results, e.g preliminary design
4. Analyse data objectively using quantitative and mathematical methods.
5. Demonstrate written communication in professional and lay domains through a progress report on their research topic outlining the acquired skills, selected methodology or solution and detailed plan that will be used in Project Part C.

This course is designed to provide the above learning outcomes which arise from targeted graduate capabilities listed in **Appendix A**. The targeted graduate capabilities broadly support the UNSW and Faculty of Engineering graduate capabilities (listed in **Appendix B**). This course also addresses the Engineers Australia (National Accreditation Body) Stage I competency standard as outlined in **Appendix C**.

### Syllabus

On completion of Project A, students will have gained detailed background knowledge of the chosen topic area, acquired preliminary skills, proposed solution and formulated initial plan. These initial research tasks will be used as a basis for further developing their skill, refining their solution, and revising their research plan in Project B. The course will also allow students to reflect on their progress including their research experience in Project A. Students will produce a mid-term progress report to outline their progress and demonstrate their development. In addition to completing preliminary work required for the research task, students are also expected to begin working on the execution of the main task in this course. As a way of demonstrating their progress in this regard, student's participation effort will be key and assessed in the form of regular weekly online meetings with supervisor and regular weekly submissions of a three-page update report.

## Teaching Strategies

### Delivery Mode

- 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 some assistance from technical staff

### Learning in this course

The project 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.

While a majority of the design and synthesis tasks will be carried out in the third term (Project C), it is important that you take full advantage of time in the second term to complete preliminary works, refine your solution, formulate detailed plan, and begin the design and synthesis tasks.

Regular online meetings with your supervisor are important not only because one of the assessments in this course is participation effort but also to check 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. Pre-arranged consultations are often more effective, check [contact details](#) on the School website.

Having completed Project Part A, at this stage you should have preliminary idea what you are going to do, and what tasks have got to be performed on the way to achieving your goal. In this Project part B, you will further develop the preliminary idea into a clear idea and refine the research tasks to set achievable milestones and solid plan towards accomplishing your objectives. Moreover, you will be expected to begin executing the main task of the project in this Project part B.

Once the research tasks are refined, careful and detailed planning is an important task in this course. The time duration of each task should be carefully checked to ensure if 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.

## ASSESSMENT

Assessment is based on evaluating the student's work through the progress report (50%) and participation effort (50%). The assessments will be carried out by the **thesis supervisor only**.

It is intended that Project B covers completing preliminary work that was started in Project A to acquire and demonstrate the required skills, detailed and revised planning, refining solution (methodology) and initial work into executing the main task. To measure these achievements through the progress report, the marking breakdowns are: (i) 60% for completing preliminary work, refining solution (methodology) and producing initial results from project execution; (ii) 15% for detailed and revised project planning; (iii) 15% for reflection on progress including the research tasks and experience in Project A; (iv) 10% on the presentation.

The progress report is to be submitted by **12pm, Thursday week 5 of the term**. For those doing B&C together, the progress report must be submitted by **12pm, Thursday week 3 of the term**. This is done by uploading the report via Moodle as a pdf formatted file. The progress 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 marking of the participation effort is based on: (i) student’s attendance at lab and online meetings throughout the term, levels of intellectual contribution (e.g. did the student come up with ideas), examination of relevant documentation (project diary, student’s lab book detailing experiment activities or measurement records), etc; (ii) submission of a three-page executive summary and a meeting log sheet in week 10.

The three-page executive summary and meeting log sheet are to be submitted by 12pm Thursday in week 10. This is done by uploading the summary via Moodle as a pdf formatted file. The summary must also 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)

It is most important to note that Project B is not just about completing preliminary work but also producing initial results from the execution of the main task. Students must demonstrate real progress in the project with tangible project deliverables. It is also expected that students have already undertaken and completed the literature review in Project A, and the literature review should not be the focus of Project B.

**Policy for lateness**

The penalty is detailed below:

- For Project progress 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 (weekends count as days). Any Project report not turned in within 6 weeks after the deadline will be finalised at zero (0) marks.
- For participation effort – 1 mark off the participation mark for every day late submission of three-page weekly update report.

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

**Relationship of Assessment Methods to Learning Outcomes**

Assessment	Learning outcomes				
	1	2	3	4	5
Written report	✓	✓	✓	✓	✓
Participation effort	✓		✓	✓	✓

**COURSE RESOURCES**

**Recommended texts(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

### Progress report

A written report is to be submitted in **week 5 (Thursday 12 pm)**, by uploading the report as one single pdf formatted file. **For those who are doing Project B and C together, the due date for submitting the report will be in week 3 (Thursday 12pm)**. The report will have three key aspects: (i) 5-6 pages of progress – progress made on the project since Thesis A; (ii) 1-2 pages of reflection; (iii) 1-2 pages of updated planning. The marking rubrics for the report is provided in Table 1.

The report must be individually written even for cases where a group of students work on the same topic. Submission is via Moodle.

### Three-page executive summary

A three-page executive summary should be submitted on Thursday 12pm in **week 10** by uploading a pdf formatted file. The file should also include a meeting log sheet as an additional attachment. This applies to those who are doing Project B and C together.

There are no any particular formats for the three-page executive summary and meeting log sheet. The report should be able to summarize the progress that has been made since the beginning of the term. The executive summary must be submitted individually even for a group project. Submission is via Moodle.

**Table 1: Progress report marking rubrics**

Description	Wt	Accomplished	Distinguished	Solid	Adequate	Deficient
Mark bands		85-100	75-84	65-74	50-64	0-49
<b>Progress (5-6 pages)</b>	60%	Achievement is beyond expectations with respect to plan. If any complexities or challenges have been encountered, a plan for equivalent work has been developed with significant progress made. Highly detailed discussions on work completed. The student is clearly on track to demonstrate a sophisticated understanding of the meaning and implications of their research findings.	Highly satisfactory achievement against the plan. If complexities or challenges have been encountered, a plan for equivalent work has been developed with satisfactory progress made. Detailed discussions on the work completed. The student clearly on their way to demonstrating a good understanding of the meaning and implications of their research findings.	Mostly satisfactory achievement against the plan. If complexities have been encountered a plan for equivalent work has been developed and a good start has been made. Some discussion of the work completed. The student looks to be developing a reasonable understanding of the meaning of their research findings.	Marginal achievement compared to the plan. If complexities have been encountered a plan for equivalent work has been developed but with little progress. Only superficial discussions of the work completed. The student will probably be able to demonstrate some understanding of the meaning of their results.	Achievement is not satisfactory with respect to the plan. Little work has been done to address any complexities or challenges encountered. Little or no discussion of the work completed. It is unclear that the student understands what their results mean.

Description	Wt	Accomplished	Distinguished	Solid	Adequate	Deficient
Mark bands		85-100	75-84	65-74	50-64	0-49
<b>Reflection</b>	15%	Compares and contrasts the thesis, with industrial and other academic experiences, illuminating the differences and similarities between them. The student also demonstrates deep understanding of their field(s) of study and broadening perspective through the research experience. Evaluates changes in learning through the thesis, recognizing complex contextual factors (e.g. works with ambiguity and risk, deals with frustration), demonstrating self-awareness, and envisions a future self or develops plans that build on the research experience.	Compares and contrasts the thesis, with industrial and other academic experiences, illuminating the differences and similarities between them. The student also demonstrates a growing understanding of their field(s) of study and developing perspective through the research experience. Evaluates changes in learning through the thesis, through either recognizing complex contextual factors (e.g. works with ambiguity and risk, deals with frustration), demonstrating self-awareness, and/or envisioning a future self / developing plans that build on the research experience.	Compares and contrasts the thesis, with industrial and/or other academic experiences, illuminating the differences and similarities between them. Evaluates changes in learning through the thesis, recognizing complex contextual factors (e.g. works with ambiguity and risk, deals with frustration).	Compares and contrasts the thesis, with industrial or other academic experiences, inferring differences and similarities between them. Articulates strengths and challenges during the thesis, with contexts.	Identifies superficial connections between the thesis, and industrial or other academic experiences. Describes own performances during the thesis with general descriptors of success and failure at a superficial level.
<b>Revised project plan</b>	15%	Highly thoughtful and incisive discussions on future project plan and expected results. A reasonable strategy to ensure progress is stated, explained in detail and innovative.	Quality discussion of the future project plan and expected results. A reasonable strategy to ensure progress is stated and explained in detail.	Some discussions of future project plan and outcomes. A reasonable strategy to ensure progress is stated and briefly explained.	Superficial discussion of future project plan &/or outcomes. A reasonable strategy to ensure progress is stated.	Little or no discussion of future project plan or outcomes. No reasonable strategy to ensure progress is stated.

Description	Wt	Accomplished	Distinguished	Solid	Adequate	Deficient
Mark bands		85-100	75-84	65-74	50-64	0-49
<b>Document presentation</b>	10%	The document follows a clear and logical structure indicated using headings and other conventions. The report is very easy to read: well-written, with good spelling and grammar, and appropriate language style. Text spacing aids readability. All aspects of formatting are consistent throughout the document. Graphical and tabular presentation of data is appropriate, clear, consistent and economical. Discernment is shown in the placement of graphical elements (figures, tables, etc.), whether in the body of the work or in the appendices. References in text match reference list (and vice versa) and are cited properly.	The document makes good use of headings, sub-headings and other stylistic conventions to indicate document structure. The report is easy to read: writing is clear enough, with good spelling and grammar, and reasonable choice of language style. Graphical elements (figures, tables, etc.) are labelled, largely formatted consistently and cited correctly. References in text match reference list (and vice versa) and are cited properly.	The document makes some use of headings and other stylistic conventions to indicate document structure. The report is reasonably easy to read: there may be some issues with spelling, grammar or style but it doesn't affect comprehension. Figures and diagrams are generally fine, although there may be some issues with the graphical presentation of data - poor choice of axes, overcrowding, poor use of chart space, etc. References in text match reference list (and vice versa) and are cited properly.	Document is not at a professional level but does make use of headings and sub-headings to indicate document structure. The report is may be difficult to read: writing is just ok, broad idea comes across; spelling and grammar have some flaws, not quite appropriate language style. Although figures and tables are labelled, the formatting is unclear and/or inconsistent to the extent that the reader can lose track of the context when reading. References in text match reference list (and vice versa) and are mostly cited correctly.	The document is poorly structured, does not cohere or shows a lack of understanding of the purpose of its sections. Much effort is required to read and understand the report: writing is poor, many mistakes with spelling and grammar, and possibly inappropriate language style (e.g. too informal) Presentation is poor to the extent that it impedes reading of the document. Examples include inconsistent formatting, and unlabelled figures or tables. References are either not cited or cited inconsistently.

### 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 Thesis Coordinator, the Director of Academic Studies in EE&T or the Student Counselling 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.

### OTHER MATTERS

#### Dates to note

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

#### 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>.

#### Student Responsibilities and Conduct

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



## Workload

It is expected that you will spend at least **10 hours per week** studying a 4 UoC course, from Week 1 until the final assessment, including both online classes and *independent, self-directed study*. In periods where you need to 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 class they may be refused final assessment.

## General Conduct and Behavior

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.

## 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>.

## Continual Course Improvement

This course is under constant revision in order to improve the learning outcomes for all students. Please forward any feedback (positive or negative) on the course to the course convener or via the online student survey myExperience. You can also provide feedback to ELSOC who will raise your concerns at student focus group meetings.

## 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>

# APPENDICES

## Appendix A: Targeted Graduate capabilities

Electrical Engineering and Telecommunications programs are designed to address the following targeted capabilities which were developed by the School in conjunction with the requirements of professional and industry bodies:

- The ability to apply knowledge of basic science and fundamental technologies;
- The skills to communicate effectively, not only with engineers but also with the wider community;
- The capability to undertake challenging analysis and design problems and find optimal solutions;
- Expertise in decomposing a problem into its constituent parts, and in defining the scope of each part;
- A working knowledge of how to locate required information and use information resources to their maximum advantage;
- Proficiency in developing and implementing project plans, investigating alternative solutions, and critically evaluating differing strategies;
- An understanding of the social, cultural and global responsibilities of the professional engineer;

- The ability to work effectively as an individual or in a team;
- An understanding of professional and ethical responsibilities;
- The ability to engage in lifelong independent and reflective learning.

### Appendix B: UNSW Graduate Capabilities

The course delivery methods and course content directly or indirectly addresses a number of core UNSW graduate capabilities, as follows:

- Developing scholars who have a deep understanding of their discipline, mostly through self-study with little guidance from staff.
- Developing rigorous analysis, critique, and reflection, and ability to apply knowledge and skills to solving problems encountered in the course of Project work.
- Developing capable independent and collaborative enquiry, through self-study and information gathering spanning the duration of the course.
- Developing digital and information literacy and lifelong learning skills through the literature review and selective gathering of background technical information required for the project.
- Developing ethical practitioners who are collaborative and effective team workers, through group activities, seminars.
- Developing independent, self-directed professionals who are enterprising, innovative, creative and responsive to change, through challenging design and project tasks.
- Developing citizens who can apply their discipline in other contexts, are culturally aware and environmentally responsible, through interdisciplinary tasks, seminars and group activities.

### Appendix C: Engineers Australia (EA) Professional Engineer Competency Standard

	Program Intended Learning Outcomes	
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals	
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing	1,3,4
	PE1.3 In-depth understanding of specialist bodies of knowledge	1,2,3,4,5
	PE1.4 Discernment of knowledge development and research directions	2,5
	PE1.5 Knowledge of engineering design practice	1,3
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice	1,3
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving	1,3,4
	PE2.2 Fluent application of engineering techniques, tools and resources	1,3,4
	PE2.3 Application of systematic engineering synthesis and design processes	1,3
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects	1,3
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability	1,2,5
	PE3.2 Effective oral and written communication (professional and lay domains)	2,5
	PE3.3 Creative, innovative and pro-active demeanour	1,3,5
	PE3.4 Professional use and management of information	5
	PE3.5 Orderly management of self, and professional conduct	5
	PE3.6 Effective team membership and team leadership	1,5

