

## ELEC4951 Research Thesis A

### COURSE STAFF

Thesis supervisor: To be nominated by the student (together with thesis topic)  
Thesis coordinator: Dr. Aron Michael, EE 316, [a.michael@unsw.edu.au](mailto:a.michael@unsw.edu.au)

**Consultations:** About the thesis work, technical inquiries should be directed to the thesis supervisor whereas general administrative inquiries should be directed to the thesis coordinator. All email enquiries should be made from your student email address with ELEC4951 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: **ELEC4951/9451 - Research Thesis A/Masters Project A T3/2020.**

### COURSE SUMMARY

#### Contact Hours

The thesis consists of regular Online meetings with the supervisor, typically about 30 minutes weekly. In addition, the thesis 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 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.

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 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 thesis 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 thesis 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.

## Schedule

Period	Activity
	<ul style="list-style-type: none"> <li>▪ Prior to start of the term, student selects thesis topic and gets approval from supervisor.</li> <li>▪ Weekly Online meetings during the term with supervisor for technical guidance on thesis 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>▪ Overview of thesis work - Introductory talk by Thesis Coordinator</li> <li>▪ 4pm Friday: deadline for registering your thesis topic and supervisor name via Moodle portal 'EET School Thesis/Project'</li> </ul>
Week 1-2	<ul style="list-style-type: none"> <li>▪ Provide Thesis details for each assessment via the Moodle course page 'ELEC4951/9451 Research Thesis A/Masters Project A T3 2020' <ul style="list-style-type: none"> <li>○ For start, provide general thesis topic, your name and supervisor's name urgently. Thesis topic does not have to be finalized at this stage as it can be updated till week 8.</li> <li>○ The details should be provided for each assessment. In this course, the assessments are PART A SEMINAR ASSESSMENT and PART A REPORT ASSESSMENT.</li> <li>○ To provide the details for PART A SEMINAR ASSESSMENT, follow the steps below <ul style="list-style-type: none"> <li>▪ Go to Thesis A Seminar (click to expand the section)</li> <li>▪ Click on PART A SEMINAR ASSESSMENT and follow the prompt</li> </ul> </li> <li>○ To provide the details for PART A REPORT ASSESSMENT, follow the steps below <ul style="list-style-type: none"> <li>▪ Go to Thesis A Report (click to expand the section)</li> <li>▪ Click on PART A REPORT ASSESSMENT and follow the prompt</li> </ul> </li> </ul> </li> </ul>
Week 2	<ul style="list-style-type: none"> <li>▪ Thesis guide – Online seminar by Prof. Victor Solo</li> </ul>
Week 5	<ul style="list-style-type: none"> <li>▪ Risk Management Form completed and approved by supervisor</li> <li>▪ If applicable, ethics approval required from relevant authority</li> </ul>
Week 8-9	<ul style="list-style-type: none"> <li>▪ <b>Online Seminars</b>, time to be announced during Week 7</li> </ul>
Week 10	<ul style="list-style-type: none"> <li>▪ 12pm Thursday: deadline for submission of your <b>report</b> via Moodle.</li> </ul>

## Assessment

- |            |               |
|------------|---------------|
| 1. Seminar | 43% weighting |
| 2. Report  | 57% 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 a 2.1 UOC, level 4. The expected workload is 10 hours per week throughout the 10 week term.

### Relationship to Other Courses

This is a fourth-year core course for students following a BE (Electrical) or (Telecommunications) program in the EE&T School and other combined degree programs. This course constitutes the first part (Thesis A) of the three-part thesis work (Thesis A, B and C). It involves a detailed literature search and reviews of the background for the chosen topic, familiarisation with the tools or equipment required for the project, some preliminary design/developmental work, and formulation of a research plan. This prepares the student for the detailed project work that will be undertaken in Thesis B and C in the following subsequent two terms.

### Pre-requisites and Assumed Knowledge

The pre-requisite for this course is completion of 126 UOC and third year core courses.

### Following Courses

The course is a pre-requisite for ELEC4952 which must be taken in the immediate following 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 exhibit detailed background knowledge of 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. Demonstrate completion of initial stages of this process, e.g. preliminary design.
4. Analyse data objectively using quantitative and mathematical methods.
5. Demonstrate oral and written communication in professional and lay domains through an online seminar presentation and a written report on their chosen research topic outlining the motivation, background and selected methodology that will be used in Thesis Part B.
6. Explain the general infrastructure requirements of engineering projects including laboratory, workshop, computing facilities, information systems and WHS requirements. Understand the role thesis supervisors play in quality assurance.

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

The thesis project topic area chosen by the student may be in any technical area covered by the interests and expertise of the academic staff of the EE&T School who will act as the project supervisors. A list of topics offered by the school is published each year and can be viewed on the Moodle 'EET School Thesis/Project' database. Students are to make their own selection. Usually, the topic chosen is influenced by the students' future career directions. Note that some topics offered on the list are of a general nature, requiring the topic to be defined in

discussion with the supervisor. Many topics can be modified to cater for specific student interests. There is provision for 'wildcard' topics nominated by students or industry. However, it is required to find an academic staff who can recognize the technical merits and is prepared to act as a supervisor (or co-supervisor) of such a topic.

In addition to the key elements of problem analysis and synthesis, the course requires information literacy, revision and explicit application of project management concepts, safety considerations, and risk mitigation. The assessment includes both written and oral communications – the students will deliver professional online seminar presentations on their chosen research topic outlining the motivation, background and selected research methodology that will be employed in Thesis B and C.

## TEACHING STRATEGIES

### Delivery Mode

- One introduction lecture by the course coordinator – to explain thesis requirements, procedures, available resources, and assessment scheme.
- Regular weekly Online meetings between supervisor and student – to discuss and advise on the thesis 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 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.

Before carrying out any research it is important to be aware of what work has been done by other researchers. You can ask your supervisor for assistance with the available resources and how to access them, e.g. IEEE-Xplore on-line database. The Internet has become a major source of information for research activities.

While a majority of the design and synthesis tasks will be carried out in the next two sessions, it is important that you take full advantage of time in the first session to grasp what the underlying problem and challenges are, as well as begin the design and synthesis tasks.

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. Pre-arranged consultations are often more effective, check [contact details](#) on the School website.

Defining a topic is difficult, but it is probably your most important task. Once you have a clear idea of what is required, you can then analyse the alternative course of actions available for achieving your goal. However, if you have the wrong problem then no amount of brilliant analysis or design will achieve the required objective.

Once you have defined your problem, review what has been achieved before, and list what alternative courses of action or methods of solution are available. Analyse the alternatives and decide which of them is the most appropriate for the task in hand. 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 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 interim report (57%) and online seminar (43% weighting). The assessment will be carried out by the thesis supervisor and the thesis assessor whose marks are equally weighed. The assessor is an academic staff assigned by the School. The same assessor will be assigned for Thesis C. The marking is done independently by each marker, without collusion or knowledge of the other mark. If there is a significant difference between the two marks for the report (>10%), the Thesis Coordinator has the discretion to decide the next course of action, e.g. ask the two markers to review their marks.

It is intended that Thesis A covers the planning, preparing and completing some initial work on the project. To measure these achievements through the report and online seminar, the marking breakdowns are: (i) 50% on gathering, understanding and prioritizing relevant technical background about the project, literature review and the problem statement; (ii) 20% on project planning (proposed solution or methodology, project timeline, identification of resources and skills); (iii) 20% on project preparation (skills acquired, training completed, preliminary results, risk assessment) and (iii) 10% on the presentation.

It is most important to note that Thesis A is not just about doing a literature review but students must demonstrate real progress in the project with tangible project deliverables.

### Policy for lateness

The penalty is detailed below:

- For thesis seminar – zero (0) mark is awarded
- For thesis report – 5 marks off the *thesis* 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 thesis (weekends count as days). Any thesis 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 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	6
Thesis online seminar	✓	✓	✓	✓	✓	
Written report	✓	✓	✓	✓	✓	✓

## COURSE RESOURCES

### Recommended text(s):

Reading materials are specified by the supervisor (related to particular thesis 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 THESIS

### How to nominate a thesis topic

The Moodle portal '[EET School Thesis/Project](#)' helps you find a supervisor and register a thesis topic to work on. Preferably, this should be done well before the start of the semester. Follow these steps:

- Go to <https://moodle.telt.unsw.edu.au/course/view.php?id=20890> and enrol yourself as a student; the self-enrolment key is EETTPstudent.
- From here, you can view the research profiles of prospective supervisors and topics by clicking on the 'Research Topics' icon. Please note that the topics list is only indicative and may not show all the topics available. Supervisors may have other new topics in mind or you may want to propose your own topic that matches the supervisor's interests and expertise.

When you have found a supervisor with a topic that suits your interests, you are required to contact this person to discuss your intention. If you both agree to team up, ask the supervisor to email you to confirm approval of the topic title. You can then proceed to register your topic:

- Go into Moodle 'EET School Thesis/Project', click 'Select Your Supervisor' icon then click 'Select Supervisor'. Find your supervisor name and click the action box to become a member.
- From the home page, click 'Select Your Supervisor' icon then click 'Register Topic', 'Add Entry' and enter your details and topic title.
- You now have formally secured a supervisor with a specific topic to work on in the forthcoming semester. Furthermore, you must enrol in the appropriate thesis course code on myUNSW, as you would normally enrol in other courses. This will give you access to the main Moodle for this course: **ELEC4951/9451 Research A T1 2020**.

### Risk Management

Your thesis work may involve practical experiments in the laboratory or only using office computers. Regardless of the nature of your thesis work, you must do a risk assessment before commencing. The *Risk Management Form* has to be completed on-line via <https://safesys.unsw.edu.au>, submitted by you, and approved by your supervisor. The system will generate a unique Risk Management Document Number for identification.

Note that when you submit your thesis report, you will be asked to state your Risk Management **Form** Document Number and also, if applicable, to indicate that appropriate ethics approvals have been obtained. Please refer to the [UNSW Health & Safety website](#) for information on how to complete a Risk Management Form, and on risks associated with certain tasks. If you are having trouble navigating the website, please contact the School's Health & Safety Advisor, [Emilio Saliba](#).

For access requirements to Labs and offices, please click [HERE](#) and follow the instructions as soon as possible.

### Thesis online seminar

During **week 8 (or week 9 depending on scheduling)**, you are required to give an online seminar presentation describing your work on the topic.

Student online seminars will take place online using MS Teams at the times agreed between the students and their markers. The duration of each online seminar will be 30 minutes. Plan your presentation to last for about 20 minutes plus 7 minutes for answering questions and 3 minutes for the changeover. By this stage you will be knowledgeable in your topic, but you should present the materials so that it can be understood by the other students attending your online seminar. Go at a steady pace. Practice the right emphasis and timing. Rehearsals will give you confidence and remove some of the nervousness.

Technical skill is very important; but just as important is the ability to talk about your work in an informative and convincing way. The online seminar provides the opportunity both to inform and to demonstrate your communication skills. Your talk should be addressed both to your examiners (supervisor and assessor) who will need to know details about your progress with the topic, and to students and staff members having a more general interest in the project.

The thesis seminar might have the following outline:

- Thesis definition, i.e. what is the problem you are trying to solve including motivation.
- Background and literature review
- Description of preliminary work (e.g. simulation, modeling, experimental procedure)
- Outline and timetable schedule for work in Thesis B and C in the following terms.

PowerPoint slides or Acrobat PDF for presentation are recommended.

### Written report

A written report is to be submitted in **week 10 (Thursday 12pm)**, by uploading the report as one single pdf formatted file. This file should include, as the first page, a scanned image of the report cover sheet. The report cover sheet can be downloaded from the course web site. The report must also include an Appendix for a scanned copy of the completed Risk Assessment Form. If using double space and size 12 font, a typical report is about 15 to 25 pages (everything included: graphs, figures, diagrams, attached forms).

As with the seminar, the report should contain the following elements:

- Abstract / Table of contents / Introduction / Body / Conclusion (these do not necessarily constitute Chapter titles).
- Project definition, which includes the problem statement, and motivation for trying to solve this particular problem, possible solutions to the problem along with their pros and cons and challenges.
- Literature review.
- Description of preliminary work – although much of the design and synthesis will be carried out in Thesis B, it would be expected that preliminary work would be carried out in Thesis A.
- Outline and timetable schedule for work in Thesis B and C in the following terms. This should be more than just a simple Gantt chart. This should include a description of the work required to be carried out in Thesis B and C, and possible perceived problems or risks you may encounter which could change the schedule and planned work.

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

### 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 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.

## 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 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.

### **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.

### **Ethics approval**

The thesis work may require ethics approval. Does your thesis involve other people doing something for you? If so, it may require ethics approval. The basic principle is that if you want people to provide you with something, even if just 5 min of their time to answer questions, then you should (i) treat them with suitable dignity and (ii) ensure any possibility that they may be badly affected is absolutely minimised. When research at UNSW involves people, then it comes under the oversight of the UNSW Ethics Committee which must give approval before it proceeds.

You will need to get approval if your project involves any of the following (more than one may apply):

- a survey, even if done on-line
- an interview, focus group, or other such “qualitative” method
- data-mining, when individual identities might be revealed
- behavioural observation, e.g. people using something, choices people make, on-line activities
- recording or photography of people, even if in public spaces
- experiments on human reactions (or other abilities)
- human performance, e.g. running, falling, playing music
- testing a device
- tasting or smelling, e.g. foods
- drug trials, body tissues and other medical activities.
- experiments on animals

If your project does require approval, in the first instance, discuss it with your supervisor.

### **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 Course and Teaching Evaluation and Improvement Process. You can also provide feedback to ELSOC who will raise your concerns at student focus group meetings.

In our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods. The assessment criteria and marking guidelines have been extensively revised together with clearly-defined policies on handling marking differences and late submission of work. Course administration is now via Moodle where students can access online databases, find supervisors to sign up topic, obtain course material and submit their work for assessment.



**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:

<http://www.engineering.unsw.edu.au/electrical-engineering/policies-and-procedures>

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

## 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 thesis 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	
<b>PE1: Knowledge and Skill Base</b>	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals	
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing	✓
	PE1.3 In-depth understanding of specialist bodies of knowledge	✓
	PE1.4 Discernment of knowledge development and research directions	✓
	PE1.5 Knowledge of engineering design practice	✓

	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice	
<b>PE2: Engineering Application Ability</b>	PE2.1 Application of established engineering methods to complex 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	✓
<b>PE3: Professional and Personal Attributes</b>	PE3.1 Ethical conduct and professional accountability	✓
	PE3.2 Effective oral and written communication (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	