



## ELEC9716 Electrical Safety

### COURSE STAFF

Course Convener: Dr. Jayashri Ravishankar, Room 122 (G17), [jayashri.ravishankar@unsw.edu.au](mailto:jayashri.ravishankar@unsw.edu.au)

Course contact (Mentors): Swapneel Thite [s.thite@unsw.edu.au](mailto:s.thite@unsw.edu.au)

**Consultations:** You are encouraged to ask questions on the course material, via Class Team forums and group mentors. Active participation in the online discussion forum is expected to provide peer-to-peer support. Email enquiries are not encouraged. If an email enquiry becomes necessary, it should be made from your student email address with ELEC9716 in the subject line; otherwise they will not be answered.

**Keeping Informed:** in this course, we will use Moodle <https://moodle.telt.unsw.edu.au/login/index.php> and Microsoft Teams [CLS-ELEC9716 T2 2021](#). All announcements will be via Teams and Moodle forums and via email (to your student email address), where necessary. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

### COURSE SUMMARY

#### Contact Hours

The course has an allocated 3 hours of online synchronous sessions each week.

	Day	Time	Location
<b>Synchronous lectures</b>	Thursday	4-7 pm	Online – MS Teams

Online consultation sessions with the course convener will be available right after every lecture session on Thursday. Every week you will have 45 min of consultation sessions with your group mentor. Additional face-to-face consultation sessions with the course convener will be available based on requests.

#### Context and Aims

Electrical accidents to personnel and electrically initiated fires cause a considerable loss to industry and the community every year, ranging from death and permanent debilitating injury to property damage amounting to many millions of dollars. The causes of such accidents and fires range from carelessness and/or ignorance, through to unforeseen mal operation of equipment or appliances.

The continual growth of the chemical and petrochemical engineering industries in recent years implies a corresponding increase in the number of industrial complexes involving hazards from flammable gases, vapours and mists which can produce explosive mixtures with air. At the same time the amount of electrical equipment required on such sites is increasing, so that appropriate steps must be taken to provide the protection against the possibility of gas ignition.

Explosions can cause huge loss of life and plant. In addition to the large disasters which create international news, there are numerous smaller explosions and fires such as those in small paint spraying areas, dry-cleaning

premises and the like which can also cause serious injury and/or substantial loss. In many cases the hazards occur in areas frequented by the public, for example petrol service stations. In all these situations, electricity is used.

The importance of this expanding area of technology has been emphasized by a number of IEE international conferences over the years. Despite the increasing importance of electrical safety in hazardous atmospheres it was reported at one of these conferences that there is still a shortage of professional engineers with appreciable knowledge of the subject and that some of the fundamentals of hazardous atmosphere electrical safety had never even been heard of by many working engineers.

The course aims to enable students to identify hazards to people and equipment that are present in the electrical environment of a power supply utility, commercial or domestic installation, at home and at medical locations, together with the design principles and working procedures that are implemented to minimise the risk of electrical accidents and fires. The legal processes that can arise as a result of electrical accidents and fires are also discussed.

The course also aims to develop competencies for practice and ability to act and display initiative via thorough analysis of explosion hazards and the various methods of overcoming these hazards. The course has assessments based on team activities and there are marks assigned for individual contributions in a team.

### Indicative Synchronous Lecture Schedule

Period	Summary of Lecture Program
Week 1	Introduction - Electricity & Human body
Week 2	No lectures – time to work on your first VR submission
Week 3	Earthing
Week 4	Hazardous area / Safe practices
Week 5	Power line safety
Week 6	Emerging energy sources
Week 7	Safety against overvoltages (OV), Extra low voltage (ELV) and Residual voltage (RV)
Week 8	Electrical safety in hospitals
Week 9	Course discussions
Week 10	Oral assessments

### Study Plan

The course is organised in modules as below.

#### Mandatory modules

- Module M1: Electricity & Human body
- Module M2: Earthing
- Module M3: Hazardous area

#### Elective modules

Choose two from the below list:

- Module E1: Power line safety
- Module E2: Emerging energy sources
- Module E3: Safety against OV, ELV, RV
- Module E4: Electrical safety in hospitals

## Assessment

VR assessment	25%
Fortnightly Quiz	25%
Case study assessment	30%
Assignment + Oral exam	20%

**Must attempt each assessment component to pass the course.**

**There are no final exams for this course during the exam period.**

## 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.

## COURSE DETAILS

### Credits

This is a 6 UoC course and the expected workload is 15 hours per week throughout the 10-week term.

### Relationship to Other Courses

This is a postgraduate course in the School of Electrical Engineering and Telecommunications. It is an advanced disciplinary elective course in the Energy Systems stream of the postgraduate study.

### Pre-requisites and Assumed Knowledge

The assumed knowledge for this course is fundamental concepts of electrical power engineering. Students of other specialisation **CANNOT** manage this course, without any background in electrical engineering. Being an elective course in energy systems, the course requires a broad understanding of electrical machine theory and power system operation. The subject material is very descriptive and a significant proportion of the assessment is of a descriptive nature. If your written English is poor, you will need a lot more time to manage the written work in course.

### Learning outcomes

After successful completion of this course, you should be able to:

1. Identify the presence of electrical hazards;
2. Employ investigative techniques for determining the cause of electrical accidents, fires and explosions;
3. Analyse electrical hazards and provide solutions to minimise risks;
4. Communicate electrical safety information in a formal engineering report / presentation / group discussion providing independent conclusions;
5. Gain familiarity with the industry procedures on electrical safety;
6. Gain awareness on electrical safety laws nationally and internationally.

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

This course covers the very broad and important area of electrical safety in domestic and industrial installations. Topic areas include, the effects of electric current passing through the human body; lightning hazards; protection of personnel: earthing and double insulation; protection of personnel: residual current detectors; effects of electric and magnetic fields and electromagnetic radiation; electrosurgical hazards; electrical fires and their investigation; electrical safety and the law; electrical safety in hazardous atmospheres: area classification; gas grouping; temperature classification; flameproof protection; intrinsic safety protection; increased safety protection; non-sparking protection; special protection; pressurization or purging protection; encapsulation, sand filled and oil filled protection; dust ignition proof equipment; cabling and terminations; certification, marking and quality control and maintenance requirements.

## TEACHING STRATEGIES

### Delivery Mode

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Lectures and industry videos embedded in virtual reality simulations, which allow a 360 degree interactive tour of various scenarios;
- Synchronous and asynchronous discussions, which provide you with a focus on the core analytical material in the course, together with qualitative, alternative explanations to aid your understanding;
- Quiz, which allow for exercises in problem solving and MCQs that allow time for you to resolve problems in understanding of lecture material;
- Mentoring sessions, that will promote group work and enhance deeper learning of the concepts;

### Learning in this course

You are expected to attend all mentoring sessions to maximise learning and show participation. In addition to the lecture notes/video, you should read relevant sections of the recommended text. Reading additional texts will further enhance your learning experience. Group learning is also encouraged. UNSW *assumes* that self-directed study of this kind is undertaken in addition to attending formal classes throughout the course.

## ASSESSMENT

The assessment scheme in this course reflects the intention to assess your learning progress through the term. Ongoing assessment occurs through the VR simulation sessions, Quizzes and Case Study presentations.

### VR Assessment

Virtual reality (VR) simulation cast 360-degree 3D images and provide several electrical related safety hazards and procedures. The students work to identify the safety hazards, work through the risk assessment questions and provide solutions for rectifying the hazards.

After completing each scenario, assessment marks will be awarded according to how much of the simulation you were able to complete.

**Each simulation carries 5% making a total of 25% towards the course.**

To check that you have achieved the practical learning outcomes for the course via the VR simulations, you will be required to complete the related MCQ Quiz via Moodle, which are due the even weeks.

**Each quiz carries 5% making a total of 25% towards the course.**

**Assessment deadline for VR completion and the related Quiz (Friday COB of the even weeks)**

## Case Study Assessment (CSA)

This is a team activity. Each team will present a video of a case study on one of the following topics related to Electrical safety:

The presentation should have the following 5 components with a maximum of 5 min video:

- 1) Explanation of the incident and identify issue
- 2) Related law/standards
- 3) Offer solution – engineering
- 4) Offer solution – administrative & PPE
- 5) Relate to learning outcomes achieved from this case study

The video will be assessed by industry experts and **contributes 30% towards the course**. Note that this mark will be individualised based on the team participation marked by the mentors and peers. It is important that you attend your team meetings with mentors especially in weeks 5, 6, 7, 8 and 9 otherwise you may risk achieving a reduced participation mark.

**CSA Video submission deadline is Monday 12 NOON AEST Week 9.**

### Assignment + Oral exam

The assignment is an individual 24-hour take home assessment. You will be answering a set of questions from the course material and research related questions. The submission will be via Moodle. **This contributes 10% towards the course.**

**Assignment will open Week 9 Thursday at 8:00 PM and close on Friday 8:00 PM AEST.**

There will also be an individual oral assessment via Zoom that will cover questions based on your case study video and other general questions. The assessment will run for 15 min. **This contributes 10% towards the course.**

**Oral assessments will be individual and will be organised throughout Week 10.** Please make yourself available during the week. The schedule can be made flexible based on your availability. If the enrolments are high, note that oral assessments may spill over to Week 11.

## STUDY PLAN

The below study plan can be used as guideline. You may also choose to complete the activities well before the deadlines.

Period	Study Plan
Week 1	Form / confirm groups; Complete the safety IQ; Choose elective modules; Commence preparation for M1
Week 2	<b>M1 – Complete VR, Quiz</b> , Meet your mentor; Finalise CSA topics and team roles
Week 3	Commence preparation for M2; Continue teamwork
Week 4	<b>M2 – Complete VR, Quiz</b> , Continue teamwork
Week 5	Commence preparation for M3; Continue teamwork
Week 6	<b>M3 – Complete VR, Quiz</b> , Continue teamwork
Week 7	Commence preparation for EX1; Continue teamwork;
Week 8	<b>EX1 – Complete VR, Quiz</b> , Continue teamwork;
Week 9	Commence preparation for EX2; <b>submit CSP video (Monday); Submit assignment (Friday);</b>
Week 10	<b>EX2 – Complete VR, Quiz, Oral assessment</b>

A guideline for a total of 150 hours of workload towards the course is below.

Period	Contact hours with course staff	Contact hours with teammates	Self-study / research	Assessment	Total
Week 1	3	2	5	-	10
Week 2	1	4	5	5	16
Week 3	4	3	4	-	11
Week 4	4	3	4	5	16
Week 5	4	3	4	-	11
Week 6	4	3	5	5	17
Week 7	4	3	5	6	18
Week 8	4	3	4	8	21
Week 9	1		10	-	11
Week 10	1		10	8	19
				<b>TOTAL</b>	<b>150</b>

### Relationship of Assessment Methods to Learning Outcomes

Assessment	Learning outcomes					
	1	2	3	4	5	6
VR assessment	✓	✓	✓	-	✓	✓
Fortnightly Quiz	✓	✓	✓	-	✓	✓
Case study assessment	✓	✓	✓	✓	✓	✓
Assignment + Oral	✓	✓	✓	✓	✓	✓

## COURSE RESOURCES

### Textbooks

### Textbooks

Course material compiled by the course coordinator is available online in Moodle via the Moodle book App. The lecture slides and lecture videos will be made available in Moodle as well, with links to numerous online videos.

### Reference books

- Massimo A.G. Mitolo, "Electrical Safety of Low-Voltage Systems", Mc Graw Hill, 2009.
- John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, "Electrical Safety Handbook", 3rd edition, McGraw-Hill, 2006.
- J. Maxwell Adams, "ELECTRICAL SAFETY - a guide to the causes and prevention of electrical hazards", The Institution of Electrical Engineers, 1994.
- W. Fordham Cooper, "Electrical Safety Engineering", second edition, Butterworth & Co., 1986.
- D.C. Winburn, "Practical Electrical Safety", Marcel Dekker Inc., 1988.
- Handbook of International Electrical Safety Practices, Princeton energy Resources International, 2010, Scrivener Publishing, USA.

## On-line resources

### Moodle

As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Assessment marks will also be made available via Moodle: <https://moodle.telt.unsw.edu.au/login/index.php>.

### Mailing list

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

## 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 **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.

#### 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.

#### 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/STEEP who will raise your concerns at student focus group meetings. As a result of previous feedback obtained for this course and in our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods.

- The quiz questions are better aligned to the course material.
- Face-to-face options for teamwork are made available.

## 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, through lectures and solution of analytical problems in tutorials and assessed by assignments and written examinations.
- Developing rigorous analysis, critique, and reflection, and ability to apply knowledge and skills to solving problems. These will be achieved by the laboratory experiments and interactive checkpoint assessments and lab exams during the labs.
- Developing capable independent and collaborative enquiry, through a series of tutorials spanning the duration of the course.
- Developing digital and information literacy and lifelong learning skills through assignment work.
- Developing ethical practitioners who are collaborative and effective team workers, through group activities, seminars and tutorials.
- 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

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