School of Electrical Engineering and Telecommunications

Term 2, 2020
Course Outline

ELEC9716 Electrical Safety (Online offering)

COURSE STAFF

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

Course contact (Mentor): Swapneel Thite s.thite@unsw.edu.au

Consultations: You are encouraged to ask questions on the course material, via Moodle discussion forums and group mentors. Active participation in the online discussion forum is expected to provide peer-to-peer support. For only those questions that remain unresolved via the above means, you are encouraged to contact the lecturer or the mentor via email. 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: Announcements will be regularly made via Moodle forums and via email (to your student email address) – 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.

COURSE SUMMARY

Contact Hours

The course has an allocated 3 hours of online synchronous sessions each week. The first one hour will be the topic overview lecture every week. The times 5-7 pm will be scheduled as group meeting with the mentor - these times can be made flexible, based on adjustments with you teammates and allocated mentor.

	Day	Time	Location
Synchronous sessions	Monday	4-7 pm	Online – BB collaborate or MS Teams

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 petro-chemical 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 of 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 factory works 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, 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 (Long weekend – holiday)
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	20%

Pass each assessment component to pass the course. There are no final exams for this course.

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 a 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;
- Online 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 (Thursday COB of the even weeks)

Assignment

This is individual 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 20% towards the course**.

Assignment submission deadline is Friday COB Week 7.

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 20% towards the course**. Note that this mark will be indivdualised based on the team participation marks marked by the mentors.

CSA Video submission deadline is Friday COB Week 8.

There will also be an individual oral assessment 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; Meet your mentor; Complete the safety IQ; Choose elective modules; Commence preparation for M1
Week 2	M1 – Complete VR, Quiz, Finalise CSA topics and team roles
Week 3	Commence preparation for M2; Continue teamwork
Week 4	M2 – Complete VR, Quiz, Continue teamwork
Week 5	Commence preparation for M3; Continue teamwork
Week 6	M3 – Complete VR, Quiz, Continue teamwork
Week 7	Commence preparation for EX1; Continue teamwork; Submit assignment;
Week 8	EX1 – Complete VR, Quiz, Continue teamwork; submit CSP video
Week 9	Commence preparation for EX2;
Week 10	EX2 – Complete VR, Quiz, Oral assessment

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	2	4	5	5	16
Week 3	3	4	4	-	11
Week 4	3	4	4	5	16
Week 5	3	4	4	-	11
Week 6	3	4	5	5	17
Week 7	3	4	5	6	18
Week 8	3	6	4	8	21
Week 9	1		10	-	11
Week 10	1		10	8	19
				TOTAL	**150**

Relationship of Assessment Methods to Learning Outcomes

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

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 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 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.

- Several formative assessments have been included to ensure a continuous learning culture.
- 360 degree virtual reality simulations have been added to the course this year.
- More systematic team activities have been added.

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

	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	✓
	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	✓
PE2: Engineering Application Ability	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	✓

PE3: Professional and Personal Attributes	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	✓