ELEC9716
Electrical Safety

Course Outline – Summer session 2015/2016

Never Stand Still | Faculty of Engineering | School of Electrical Engineering and Telecommunications

Course Staff

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Consultations: You are encouraged to ask questions on the course material, after the lecture class times in the first instance, rather than via email. Lecturer consultation times will be advised during lectures. ALL email enquiries should be made from your student email address with ELEC9716 in the subject line; otherwise they will not be answered.

Course Details

Credits

This is a 6 UoC course and the expected workload is 10–12 hours per week throughout the semester.

Contact Hours

The course consists of 3 hours of lectures at EEG24 (building G17).

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.

Aims of the course

- The course aims to provide students with an understanding of the 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 provide students with a thorough understanding of explosion hazards and the various methods of overcoming these hazards.

Relationship to Other Courses

This is a postgraduate course in the School of Electrical Engineering and Telecommunications. It is a specialization 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 can also manage this course. The subject material is very descriptive and a significant proportion of the assessment (including the assignment) is of a descriptive nature. If your written English is very poor you should consider very carefully before committing yourself to this course.

Learning outcomes

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

1. Gain skills in identifying the presence of electrical hazards, implementing measures to minimise risks and develop skills in investigative techniques for determining the cause of electrical accidents, fires and explosions.
2. Assess and provide solutions to a practical case study.
3. Write a formal engineering report with independent conclusions.

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 attributes (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 including the Australian electricity safety act; electrical safety in hazardous atmospheres: area classification; gas grouping; temperature classification; electrical equipment in hazardous areas; safety issues with emerging energy sources; electrical safety in medical environment; risk assessment procedure.

Teaching Strategies

Delivery Mode

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

- Formal face-to-face lectures, which provide you with a focus on the core analytical material in the course, together with qualitative, alternative explanations to aid your understanding; The lectures will be extensively supplemented with numerous practical case study examples and video recordings.
- Tutorials, which allow for exercises in problem solving and allow time for you to resolve problems in understanding of lecture material;
- There may be more than one guest speaker and panel discussion from industries. These lectures will be organised during the regular lecture times. The announcement will be available in the course website as and when these are finalised.

Learning in this course

You are expected to attend all lectures, tutorials, and mid-semester exams in order to maximise learning. Guest speakers from industry provide an important learning benefit by giving students real world knowledge experiences and act as role models. It is expected that all students make themselves available for these lectures as this will provide a positive reflection of industry personal on University students. 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 face-to-face classes throughout the course.

Indicative Lecture Schedule

Period	Summary of Lecture Program
30-Nov-15	General principals of electric safety
02-Dec-15	Electricity & Human body
04-Dec-15	Earthing / Grounding
14-Dec-15	Safety against over voltage, extra-low and residual voltages
16-Dec-15	Safe practices – RCD, PPE, CB, lockout/tagout
18-Dec-15	**Mid-Semester Exam**
Break	
11-Jan-16	Hazardous areas, Electrical insulation
13-Jan-16	Risk assessment & management (by Dr. Iain Skinner)
15-Jan-16	Electrical fires, Arc flash
25-Jan-16	Electrical safety in hospitals **Assignment due**
27-Jan-16	Safety issues with emerging energy sources
29-Jan-16	Guest lectures from industry **Team work due**

Assessment

The assessment scheme in this course reflects the intention to assess your learning progress through the semester.

Assignment	**20%**
Team Work	**5%**
Mid-Semester Exam	**20%**
Final Exam (3 hours)	**55%**

Assignment

The assignment is based on an actual case study. You will be required to elaborate on a case study (either from your work place or elsewhere) and write a report giving your main reasons for the cause of the accident and who you think was to blame for the accident (i.e. employee or employer). You will also be required to provide suggestions of how you believe this type of accident could be best avoided in the future. The report should include the following:

- Explanation of the safety terms involved relating to the law/standards
- Related work in this area (minimum three references) – references need to be cited in relevant places and listed as per IEEE or Harvard referencing system – highlight key learning points from the references
- Approximately 10 pages
- Individual report
- Due 25 January 2016
- The report submission is online through Moodle as a pdf file. The file name should be XXX_yyy.pdf, where XXX represents your last name and yyy represents your student id.
- Any report submitted after the due date/time is liable to have marks deducted (20% for every day late). Delays on medical grounds are accepted on submission of special consideration.
- Also be aware that plagiarism is considered a very serious academic misconduct which will result in zero marks for the course!

Peer review for the assignment

The assignment marking is based on peer review of at least 3 submissions and self-assessment of your own work. The total mark including the assignment submission and peer review is 20% towards the course. Please note the following regarding the peer and self-assessments.

- The submissions and peer review will be setup through the course website in Moodle.
- Assessment criteria and feedback rubric will be clearly outlined in the course website after setting this up.
- Each student should review at least three submissions, which will be assigned at random.
- Self-assessment is also added. If your self-grade is within 5% of the median score of the peer grades, then the final assignment grade is the maximum of these scores. If the self-grade is outside the 5% of the median peer grade or it is lower, then it would not be counted in the final assignment grade.
- A penalty of 20% applies if students fail to assess less than 3 submissions assigned to them, or fail to complete the self-assessment of their own submission.

Team Work

You will be required to undertake risk assessment for a location at your workplace or any lab in UNSW. Further details will be made available during the risk assessment lecture. This is a team work (maximum 4). The deadline for submission is Friday 29 January 2016.

Mid-Semester Exam

- The test is scheduled on **18 December 2105**. The pattern for the test will be announced closer to this date.
- The tests will give a good practice for sitting the final exam.
- It is important to note this date in your diary. If a student is unable to attend the tests for medical or other serious reasons (i.e., a death in the immediate family) the student **must present medical certificates** and/or other documentation to the lecturer on or before **11 Decemeber 2015**, for any special consideration. If this is not done within the required time period then no consideration will be given and the student will have the risk of losing the marks straightaway in the final exam. Please note that **no re-test** will be provided. In case of missing the test for one of the reasons above, the assessment will be carried over to the final exam; i.e., the final exam will become a higher % of the assessment. In other words, the final exam will be assessed for 75% instead of 55%, for this student.

Final Exam

The exam in this course is a standard 3 hour open-book written examination. Printed lecture material will be made available for this course and you are allowed to bring this as the examination material. University approved calculators are allowed. All exam materials will be checked. Anyone, using other material will be asked to quit the exam hall and the result will be a fail.

The exam pattern will have a good mix of descriptive and analytical questions. Since this is an open-book examination, the descriptive questions will not be straightforward and would require you to search around the printed document for answers. It is therefore good for you to give a thorough read of the lecture material. Please note that the course material should NOT have any other writings in it. However, you are allowed to underline or highlight texts.

The final exam is scheduled on **12 February 2016, 8:45 am – 12 noon in EEG24**. The examination tests analytical and critical thinking and general understanding of the course material in a controlled fashion. Questions may be drawn from any aspect of the course, unless specifically indicated otherwise by the lecturer. Marks will be assigned according to the correctness of the responses. *Please note that you must pass the final exam in order to pass the course. There are **no supplementary exams** available.*

Relationship of Assessment Methods to Learning Outcomes

	Learning outcomes		
Assessment	**1**	**2**	**3**
Assignment	✓	✓	✓
Team work	✓	✓	✓
Mid-semester exam	✓	✓	-
Final exam	✓	✓	-

Course Resources

Course material compiled by the course coordinator - available at the School office for sale ($10).

Recommended Textbooks

- 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

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 http://www.lc.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://my.unsw.edu.au/student/atoz/ABC.html), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **ten to twelve hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both face-to-face 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.

Keeping Informed

Announcements may be made during classes, via email (to your student email address) or via online learning and teaching platforms like Moodle. From time to time, UNSW will send important announcements via these media without providing any paper copy. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Special Consideration and Supplementary Examinations

You must submit all assignments and attend all examinations scheduled for your course. You should seek assistance early if you suffer illness or misadventure which affects your course progress. All applications for special consideration must be **lodged online through myUNSW within 3 working days of the assessment**, not to course or school staff. For more detail, consult https://my.unsw.edu.au/student/atoz/SpecialConsideration.html.

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. 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.
<You should insert here changes made to the current version of the course in response to previous feedback>

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://my.unsw.edu.au/student/atoz/ABC.html

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 review the work of the peers;
- 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 Attributes

The course delivery methods and course content addresses a number of core UNSW graduate attributes, as follows <adapt to suit course>:

- 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.

<more detail: https://my.unsw.edu.au/student/atoz/GraduateAttributes.html – please consult this particularly if your course develops skills in team work, leadership, design (innovation and creativity), ethics or communication skills>

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	✓