SOLA5056

Sustainable Energy for Developing Countries

Course Outline – Term 3, 2019

Never Stand Still | Engineering | School of Photovoltaic and Renewable Energy Engineering

Course Staff

Course Convenor: Dr Anna Bruce, TETB 318, a.bruce@unsw.edu.au

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Consultations: For all course administration enquiries, contact the course convener. For content-related questions, you are encouraged to ask staff during class and/or initiate discussion related to your question on the project Facebook page.

Staying Informed: Moodle and the project Facebook Page will be used to disseminate course material and announcements. Students are expected to monitor their UNSW email account and take careful note of all announcements.

Course Details

Credits

This is a 6 UoC course and the expected workload is 13–15 hours per week throughout the 10 week semester.

Relationship to Other Courses

This interdisciplinary course is an elective for Photovoltaics and Renewable Energy Engineering undergraduate and postgraduate students. It is also offered as an elective for students from Environment Studies and Masters of Engineering Science students from a range of disciplines.

Pre-requisites and Assumed Knowledge

There are no prerequisites or assumed knowledge for this course. Students will be placed into teams with a mix of skills appropriate for completing the interdisciplinary project, but will be expected to work independently and seek support from staff to develop the required skills e.g. for sizing small stand alone power systems.

Context and Aims

Energy services are critical for health and livelihoods, while enabling productive activities and economic prosperity. However, more than a billion people around the world in rural areas and urban slums do not have access to these services and infrastructure. Many projects and programs in rural areas of developing countries, fragile states, communities in disaster recovery and other disadvantaged communities aim to improve access to modern energy services. A range of renewable energy technologies, from small and appliance-integrated to utility-scale, are available to deliver these services cost-effectively. However, delivery of these interventions presents a range of technical, economic, social and institutional challenges. The aims of this course are to:

- Introduce students to many of the technical and non-technical issues related to the delivery of accessible, affordable and appropriate energy services and infrastructure in developing

countries and other disadvantaged communities.

- Develop and apply skills and approaches for assessing, designing and specifying sustainable rural energy projects. The course guides students in collection of data, technical characteristics of system components, building appropriate technical and economic models, and project planning.
- There is an emphasis on understanding context, appropriate design and technology selection, implementation models and capacity building for sustainable projects.

Learning Outcomes

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

1. Interpret a brief, present proposals for feedback and assessment in a range of written, oral and visual formats.
2. Understand the technical characteristics of, and design, size and specify renewable energy systems commonly deployed in developing country contexts.
3. Apply a range of multi-disciplinary methodologies, frameworks and best practices to scope, design and implement sustainable solutions to complex real-world humanitarian engineering problems.
4. Assess the performance and sustainability of these energy systems by modelling the technical and economic outcomes.
5. Creatively integrate multi-disciplinary considerations into the design process and work in interdisciplinary teams.

This course is designed to achieve the above learning outcomes which address the specific UNSW and Faculty of Engineering graduate capabilities listed in ***Appendix A***. This course also addresses the Engineers Australia (National Accreditation Body) Stage I competency standard as outlined in ***Appendix B***.

Contact Hours

This course comprises four hours of formal contact per week:

Mixed-Mode Class: **Monday 2-6 TETB G16**

Syllabus

Engagement with the course material will be centred around the major project, which, this year, will be set in the Fijian islands of Yanuca and Viwa. The project will be carried out in teams of around 4 students, and will focus on household, community, clean water and livelihoods energy needs and the development of an appropriate implementation structure for the selected technologies and the local context.

Mixed-mode classes will support the major project, including:

- Presentations from the lecturer and other experts within class to describe the status and experiences with relevant projects and technologies in developing countries; introduce development concepts and analysis frameworks; and to review best practices in design and implementation of projects.
- Discussion of concepts raised in readings, presentations and other materials during class, to assist the application of material from the lectures to the project.
- Guided interpretation of the project brief, needs assessment and human-centred design.

- Support for technical and implementation aspects of the project.
- Note that the readings and other preparation and project work must be done outside of class. This will involve meeting regularly with your group.

Attendance

You must attend all classes. If, for any reason you cannot attend class, you must contact the course convenor and notify your group in advance.

Indicative Class Schedule

The schedule for classes is given below. The topics and the order are subject to change at any time.

Wk	Date	
1	16-Sep	2:00-3:00: Course and Project Introduction
		3.00-4.00: Lecture - Energy, Poverty & Sustainable livelihoods
		4:00-5.00: Project Context
		5:00-5:30: Form teams
2	23-Sep	2:00-3:00: Lecture - Energy Access Options
		3:00-5:00: Discussion Poverty Readings
		4:00-6:00: Human centered design and needs assessment
3	30-Sep	2.00 - 3.30: Lectures - Bioenergy and Clean Water
		3.30-5.30: Present and discuss preliminary research, project ideation
4	7-Oct	*Labour Day Public Holiday*
5	14-Oct	2.00-3.30: Needs assessment results
		3.30-4.30: Lecture - Rural energy project design
		4:30-6:00: Project support in groups – prepare for return brief presentation
6	21-Oct	**Present Return Brief**
7	28-Oct	2.00-3:00: Case study
		3:00-5.00: Load assessment, project support in groups
8	4-Nov	2.00-4:00: Project Planning & Capacity Development
		4:00-6.00: Project support in groups
9	11-Nov	2.00-3:30: Technoeconomic Comparison
		3:30-4:30: Logframes & Economic Analysis
		4:30-6.00: Project support in groups
10	18-Nov	2.00-3:00: Case study
		3:00-5.00: Project support in groups
11	25-Nov	**Final Presentation**

Assessment

Assessment focusses on the major project, which takes the form of a request for proposals, as used in the development industry. In addition to the final submission, intermediate deliverables include a return brief (preliminary proposal) and a blog used to journal progress.

Weightings are as follows:

Task	%	Due
Blog	10%	weeks 1-10
Project Return Brief	20%	week 6
Project Final Submission	70%	week 11

Project

Details of assessment criteria and expectations for the project will be provided separately on Moodle e.g. in the project brief. Students will work in teams on the project, with individual assessment for the individual contribution, and a group mark component. The return brief is an intermediate assessment for the project and will be assessed as a group, with peer assessment will used to allocate marks on the basis of contribution.

An assessable blog will be created by each student to record and collate work each week throughout the semester, which will encourage consistent progress and provide a way to share and collaborate with peers working on the same part of the project.

Relationship of Assessment Methods to Learning Outcomes

Learning Outcomes	Assessment		
	Blog	Return Brief	Final Submission
1. Interpret a brief, present proposals for feedback and assessment in a range of written, oral and visual formats.		✓	✓
2. Understand the technical characteristics of, and design, size and specify renewable energy systems commonly deployed in developing country contexts.	✓		✓
3. Apply a range of multi-disciplinary methodologies, frameworks and best practices to scope, design and implement sustainable solutions to complex real-world humanitarian engineering problems.		✓	✓
4. Assess the performance and sustainability of these energy systems by modelling the technical and economic outcomes.	✓		✓
5. Creatively integrate multi-disciplinary considerations into the design process and work in interdisciplinary teams.	✓	✓	✓

Course Resources

There is no textbook for this course. However, announcements, readings and other resources related to lectures and the major project will be made available via Moodle and the Project Facebook page.

Online Resources

Moodle and Facebook will be used to disseminate teaching materials, share resources, host discussion forums and connect students with any project stakeholders outside of UNSW. Assessment marks will also be made available via Moodle.

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 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 **13-15 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 that 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 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://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 RESOC 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.

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 UNSW policies:

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

Appendix A: 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 through students working through the Problem Sets and use of modelling software for the assignment.
- 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.

Appendix B: Engineers Australia (EA) Professional Engineer Competency Standard

	Program Intended Learning Outcomes		LOs to develop competency
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	✓	