COURSE OUTLINE

ENS281 Sustainable Energy Systems

School: School of Science, Technology and Engineering

2026 | Semester 1

UniSC Sunshine Coast	BLENDED LEARNING	Most of your course is on campus but you may be able to do some components of this course online.

Please go to usc.edu.au for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1. Description

This course provides you with an introduction to energy systems so that you may understand the physical processes that govern energy conversion into forms used by society. It provides a basis with which you may form considered arguments relating to the long term suitability of various energy technologies. The balance between theory and practice provides a solid foundation for further studies in sustainable development and renewable energy.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Information session – Course Overview	1hr	Week 1	Once Only
Learning materials – Videos on key theories and demonstrating solutions to example problems.	2hrs	Week 1	12 times
Tutorial/Workshop 1 – Discussion of key concepts, examples and practice problem solving	2hrs	Week 1	13 times
Laboratory 1 – Fortnightly lab classes working in groups to conduct experiments and prepare individual reports	3hrs	Week 3	6 times

1.3. Course Topics

- Energy sources - demand and supply
- Sun - Earth interactions, Global circulation, Weather, Radiant energy, Photovoltaics
- Fluids - Wind & Hydro power
- Wave energy - Earth-moon system, tides
- Heat engines - Geothermal energy, Fuels and Greenhouse gases
- Fuel cells, Environmental impacts

2. What level is this course?

200 Level (Developing)

Building on and expanding the scope of introductory knowledge and skills, developing breadth or depth and applying knowledge and skills in a new context. May require pre-requisites where discipline specific introductory knowledge or skills is necessary. Normally, undertaken in the second or third full-time year of an undergraduate programs.

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

COURSE LEARNING OUTCOMES On successful completion of this course, you should be able to...	GRADUATE QUALITIES MAPPING Completing these tasks successfully will contribute to you becoming...	PROFESSIONAL STANDARD MAPPING * Engineers Australia Stage 1 Professional Engineer Competency Standards
1 Communicate concepts and theory relevant to sustainable energy systems	Knowledgeable Empowered	1.1, 3.2
2 Apply comprehensive theory-based understanding of the principles of energy conversion to solve practical problems.	Knowledgeable Creative and critical thinker Empowered Sustainability-focussed	1.1, 1.3
3 Demonstrate knowledge of the function and operation of energy conversion devices.	Knowledgeable Creative and critical thinker Empowered Engaged Sustainability-focussed	1.1, 1.3
4 Work in a team to collect, analyse and evaluate data obtained from experimental investigations	Knowledgeable Empowered Ethical	3.2, 3.6

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1.1	Knowledge and Skill Base: Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering discipline.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.
3.6	Professional and Personal Attributes: Effective team membership and team leadership.

5. Am I eligible to enrol in this course?

Refer to the UniSC Glossary of terms for definitions of “pre-requisites, co-requisites and anti-requisites”.

5.1. Pre-requisites

Not applicable

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

Not applicable

5.4. Specific assumed prior knowledge and skills (where applicable)

Good English comprehension and writing skills; Ability to carry out algebraic manipulation of formulae and perform numerical calculations.

6. How am I going to be assessed?

6.1. Grading Scale

Standard Grading (GRD)

High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL).

6.2. Details of early feedback on progress

Students will receive feedback on their learning progress through weekly non-assessable tutorial exercises. Tutors will be available in tutorial classes to provide individual feedback, guidance and learning support.

6.3. Assessment tasks

DELIVERY MODE	TASK NO.	ASSESSMENT PRODUCT	INDIVIDUAL OR GROUP	WEIGHTING %	WHAT IS THE DURATION / LENGTH?	WHEN SHOULD I SUBMIT?	WHERE SHOULD I SUBMIT IT?
All	1	Examination - not Centrally Scheduled	Individual	20%	60 minutes	Week 7	In Class
All	2	Report	Individual	30%	6 x reports	Refer to Format	In Class
All	3	Examination - Centrally Scheduled	Individual	50%	3 hours	Exam Period	Online Test (Quiz)

All - Assessment Task 1: Mid Semester Exam

GOAL:	The mid-semester examination gives you an opportunity to demonstrate your knowledge, understanding and skills associated with the learning outcomes in weeks 1 - 6 of this course.
PRODUCT:	Examination - not Centrally Scheduled
FORMAT:	Individual Mixed practical and theoretical written questions During tutorial class in week 7
CRITERIA:	**No.** — **Learning Outcome assessed** 1 — recall and communicate the theoretical and practical components of the course materials covered in both the lectures, tutorials and practical exercises from weeks 1-6 — 1 2 — apply the relevant theory to solve examples — 2 3 — produce correct solutions to problems using appropriate diagrams, working and mathematical notation — 3
GENERIC SKILLS:	Communication, Problem solving

All - Assessment Task 2: Practical Class Reports

GOAL:	To enhance your knowledge and understanding of the theory by performing and analysing results from experiments related to sustainable energy systems.
PRODUCT:	Report
FORMAT:	Hardcopy (paper) submission to the course coordinator. Submit: In class at the completion of the laboratory classes
CRITERIA:	

No.		Learning Outcome assessed
1	Gather and analyse data accurately and write a short summary describing the outcome(s) of the experiment and conclusions relevant to the theory that may be drawn from the results	2
2	Present your work in a clear and professional manner (layout, language, spelling, general presentation)	1
3	Work collaboratively in a team.	4

GENERIC SKILLS:	Communication, Collaboration, Problem solving, Organisation, Applying technologies

All - Assessment Task 3: End of Semester Exam

GOAL:	To demonstrate your knowledge and understanding of sustainable energy technologies and principles, and solve problems using appropriate techniques and relevant theory.
PRODUCT:	Examination - Centrally Scheduled
FORMAT:	Individual. Mixed practical and theoretical written questions. During Central Examination Period.
CRITERIA:	

No.		Learning Outcome assessed
1	recall and communicate the theoretical and practical components of the course materials covered in both the lectures, tutorials and practical exercises from weeks 1-13	1
2	apply the relevant theory to particular examples	3
3	produce correct solutions to particular problems	3

GENERIC SKILLS:	Communication, Problem solving

7. Directed study hours

A 12-unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Student workload is calculated at 12.5 learning hours per one unit.

7.1. Schedule

PERIOD AND TOPIC	ACTIVITIES
1 Overview and examples of Energy Sources, Global circulation and weather. Basic principles of fluid mechanics; Bernoulli's principle, power in flow.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions
2 Wind Energy: Aerofoils, propellers and turbines, Power extraction from fluids. Wind and Hydroelectric power generation. Wind Energy	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions
3. Wave energy: Global wave activity, extraction of energy from wave motion.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions Practical 1 - Report writing
4 Tidal Energy: Earth - moon system, tides, geographic tidal variation, energy availability and extraction, Hydro power and electricity generation.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions
5 Heat Transfer and Insulation, thermal conductivity, R-values, Conduction, Convection and Radiation.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions Practical 2 - Report writing
6 Heat, basic principle of heat engines, thermal efficiency, use and conversion of heat, Geothermal energy Insulation and Heat Transfer	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions
7 Solar Radiation. Geometry of the Earth and Sun, extraterrestrial solar radiation.	Mid-semester Exam Practical 3 - Report writing
8 Effects of the Earth's atmosphere, terrestrial radiation, solar radiation profiles and availability. Solar Collectors.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions
9 Physical systems: Solar thermal systems, radiant energy, optics of collectors, energy conversion.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions Practical 4 - Report writing
10 Physical systems. Photovoltaics: Semiconductors, solar cell construction, power from solar cells, performance characteristics, arrays of cells, concentrators. Photovoltaics: Electricity from light.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions
11 Chemical Sources of Energy: Fossil fuels. Types of fossil fuels, calorific yield, energy conversion. Combustion; Greenhouse gas emissions. Hydrogen, Fuel cells and batteries. Pollution.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions Practical 5 - Report writing
12 Biomass and Biofuels: biofuel classification, biomass production, direct combustion, pyrolysis, ethanol and methane production, alcoholic fermentation, anaerobic digestion, biodiesel, wastes and residues. Power from Fuel cells and other storage device	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions
13 Course revision and review.	Online learning materials, Tutorials, Readings, online research. Practice with tutorial questions Practical 6 - Report writing

8. What resources do I need to undertake this course?

Please note: Course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Canvas site– Please log in as soon as possible.

8.1. Prescribed text(s) or course reader

> There are no required/recommended resources for this course.

8.2. Specific requirements

Scientific calculator, or a more advanced calculator if you prefer

9. How are risks managed in this course?

Risk assessments have been performed for all studio and laboratory classes and a low level of health and safety risk exists. Some risk concerns may include equipment, instruments, and tools; as well as manual handling items within the laboratory. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the online induction training for students, and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1. Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Canvas, are electronically checked through Turnitin. This software allows for text comparisons to be made between your submitted assessment item and all other work to which Turnitin has access.

10.2. Assessment: Additional Requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

The final mark is in the percentage range 47% to 49.4%
The course is graded using the Standard Grading scale
You have not failed an assessment task in the course due to academic misconduct

10.3. Assessment: Submission penalties

Late submission of assessment tasks may be penalised at the following maximum rate:
- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task.
- 10% (of the assessment task's identified value) for the third day - 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.
- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task. Weekdays and weekends are included in the calculation of days late. To request an extension you must contact your course coordinator to negotiate an outcome.

10.4. SafeUniSC

UniSC is committed to a culture of respect and providing a safe and supportive environment for all members of our community. For immediate assistance on campus contact SafeUniSC by phone: 07 5430 1168 or using the SafeZone app. For general enquires contact the SafeUniSC team by phone 07 5456 3864 or email safe@usc.edu.au.

The SafeUniSC Specialist Service is a Student Wellbeing service that provides free and confidential support to students who may have experienced or observed behaviour that could cause fear, offence or trauma. To contact the service call 07 5430 1226 or email studentwellbeing@usc.edu.au.

10.5. Study help

For help with course-specific advice, for example what information to include in your assessment, you should first contact your tutor, then your course coordinator, if needed.

If you require additional assistance, the Learning Advisers are trained professionals who are ready to help you develop a wide range of academic skills. Visit the Learning Advisers web page for more information, or contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au.

10.6. Wellbeing Services

Student Wellbeing provide free and confidential counselling on a wide range of personal, academic, social and psychological matters, to foster positive mental health and wellbeing for your academic success.

To book a confidential appointment go to Student Hub, email studentwellbeing@usc.edu.au or call 07 5430 1226.

10.7. AccessAbility Services

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, learning disorder mental health issue, injury or illness, or you are a primary carer for someone with a disability or who is considered frail and aged, AccessAbility Services can provide access to appropriate reasonable adjustments and practical advice about the support and facilities available to you throughout the University.

To book a confidential appointment go to Student Hub, email AccessAbility@usc.edu.au or call 07 5430 2890.

10.8. Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Central Examinations
- Deferred Examinations
- Student Conduct
- Students with a Disability

For more information, visit https://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.9. Student Charter

UniSC is committed to excellence in teaching, research and engagement in an environment that is inclusive, inspiring, safe and respectful. The Student Charter sets out what students can expect from the University, and what in turn is expected of students, to achieve these outcomes.

10.10. General Enquiries

In person:

- **UniSC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **UniSC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **UniSC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **UniSC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **UniSC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **UniSC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au