WM292-15 Fundamentals of Sustainable Energy Systems

25/26

Department
WMG
Level
Undergraduate Level 2
Module leader
Freeha Azmat
Credit value
15
Module duration
14 weeks
Assessment
Multiple
Study locations
University of Warwick main campus, Coventry Primary
Distance or Online Delivery

Description

Introductory description

This module will focus on fundamental principles and concepts of energy generation, energy conversion and energy storage systems. Battery storage systems in combination with solar panels and wind turbines for remote applications will be studied. The module will also expand learner's understanding of life cycle engineering and its application for assessing the environmental sustainability of engineering systems.

This module is linked with C3, C4, C6, C7, C16, C17 of the AHEP 4.
LO1 -C7
LO2 - C4, C7, C16
LO3 - C7
LO4 - C3, C6, C7
LO5- C7, C17
LO6- C16

Module web page

Module aims

Technical aspects of global concerns about the availability of energy sources, sustainability of these sources through exploitation of new technologies or preservation of existing sources, and environmental concerns will be discussed. The problem of the demand for energy needed for increasing global population and the need for new workable global supplies of affordable sustainable energy systems will be covered. The module will also expand learner's understanding of life cycle engineering and its application for assessing the environmental sustainability of engineering systems.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Introduction to Sustainable energy
- Renewable energy
- Energy storage
- Photovoltaics
- Semi-conductors
- Analysis of photovoltaic cells
- Manufacture of solar cells and panels
- Design for photovoltaic applications
- Wind energy conversion
- Fundamentals of Life cycle Engineering
- Fundamentals of Life Cycle Analysis

Learning outcomes

By the end of the module, students should be able to:

- Describe the fundamentals principles related to renewable energy systems [AHEP:4-C7]
- Explain the benefits and constraints of energy generation, energy conversion and energy storage systems [AHEP:4-C4, C7, C16]
- Discuss the theory of life cycle analysis, including its application, reporting and interpretation requirements [AHEP:4-C7].
- Conduct a life cycle assessment of a renewable energy system using appropriate software [AHEP:4-C3, C6, C7].
- Interpret the life cycle of a renewable energy system from an environmental perspective [AHEP:4-C7, C17].
- Function effectively as an individual, and as a member or leader of a team [AHEP:4-C16].

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

- Select, use and apply approved problem-solving methods to solve complex problems and determine appropriate solutions or actions such as Define, Measure, Analyse, Improve, and Control (DMAIC), Failure Mode Effects Analysis (FMEA) or Plan-Do-Check-Act (PDCA) (S2 in all DA standards).
- Observe, record and draw accurate and auditable conclusions from data and/or developmental or test evidence (S5 in all DA standards).
- Manage assigned projects or programmes of work to meet the required specification, taking into account factors such as resource requirements, safety, quality, cost and performance or sustainability criteria for projects such as design or upgrade of new plant/equipment, installation/commissioning of plant and equipment or maintenance, repair or upgrading of plant/equipment (S6 in all standards).
- Create and manage a project or work programme plan and develop activities in a logical process embedding mechanisms for adapting to changing circumstances or requirements (S10 in ST0025 and ST0024 and S9 in ST0027 and in ST0023)

Transferable skills

- Critical thinking - Recognise patterns, themes and key messages from sometimes confused and incomplete data. Make informed decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis.
- Problem-solving - Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions. Retain an open mind, optimistic of finding solutions, thinking laterally and creatively to look beyond the obvious. Knows how to learn from failure.
- Communication - Present arguments, knowledge and ideas, in a range of formats.
- Teamwork - Operate within, and contribute to, a respectful, supportive and cooperative group climate. Sensitive to the impact of actions on others.
- Information literacy - Critical awareness of how information is gathered, used, managed and synthesised. Understanding of the relative value of different sources and the importance of provenance. The systematic collection, analysis and evaluation of information in the investigation of a topic.
- Digital literacy - Has the capabilities that enable living, learning and working in a digital society. Comfortable with using digital media to communicate, solve problems, manage information, collaborate, create and share content.
- Sustainability - Understands the climate emergency and committed to an active contribution to a sustainable world.
- Ethical values - Committed to living ethically and behaving consistent with the Warwick Guiding Principles.

Study

Study time

Type	Required
Lectures	9 sessions of 1 hour (6%)
Seminars	6 sessions of 1 hour (4%)
Online learning (scheduled sessions)	15 sessions of 1 hour (10%)
Online learning (independent)	10 sessions of 1 hour (7%)
Other activity	10 hours (7%)
Private study	40 hours (27%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Review of teaching and learning activities, including content and practice of problems/solutions.

Online forum and discussion (asynchronous).

Other activity description

On-line support / consultancy for the preliminary lifecycle model design.
On-line support sessions before assessments.

ALSO, explanation of online independent learning:

- getting familiar with using the specialist software for life cycle assessment.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

Assessment component	Weighting	Study time	Eligible for self-certification
Group assignment	40%	24 hours	No

	Weighting	Study time	Eligible for self-certification

Group report on renewable energy systems, identifying and justifying the optimal one for a given situation/environment. Each group will have different parameters and requirements.

Typical group size will be 6 students, possibly 5.
It will be subjected to peer-marking, in line with the WMG policy.

Reassessment component

Individual report			No

1600 words individual submission about evaluating renewable energy systems and identifying and justifying the optimal one for a given situation/environment.

Assessment component

Individual assignment	60%	36 hours	Yes (extension)

2400 words individual report on conducting a life cycle assessment of a component in a renewable energy system.

Apprentices will initially work during the teaching block in small groups (typically 3) to develop the preliminary life cycle model of a renewable energy system component (to promote peer-to-peer learning), and submit it as formative assessment after block 3.
They will then fully develop it individually and produce an individual report.

Reassessment component is the same

Assessment group R

	Weighting	Study time	Eligible for self-certification
Individual assignment	60%	36 hours	No

Feedback on assessment

Formative Feedback:

- Automated individual feedback on on-line Moodle revision quizzes.
- Verbal formative feedback during seminar and practical sessions.
- Cohort-level feedback on the preliminary life cycle model design of the investigated renewable energy system component.

Summative Feedback:

- Written feedback on the submitted group report.
- Written individual feedback on the submitted individual report.

Availability

Courses

This module is Core for:

- Year 2 of DWMS-H7C7 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C6 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C5 Undergraduate Applied Professional Engineering (Manufacturing Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C8 Undergraduate Applied Professional Engineering (Product Design and Development Engineer) (Degree Apprenticeship)