WM291-30 Sustainable System Design

26/27

Department
WMG
Level
Undergraduate Level 2
Module leader
Matt Sokola
Credit value
30
Module duration
42 weeks
Assessment
Multiple
Study locations
University of Warwick main campus, Coventry Primary
Distance or Online Delivery

Description

Introductory description

This 30-CATS module, running throughout the second academic year, gives learners an opportunity to apply academic knowledge to real-life scenarios/work-based challenges related to design and to sustainable engineering systems. It build from foundations of product design in Y1 30-CATS module towards the system design in Y2.

The first part of the module focuses on fundamentals of sustainable systems, ISO14001 Standard and UN Sustainable Development Goals. The second part covers a few technologies not covered in the module "Sustainable Energy Systems" (such as battery storage and thermal systems) that are a part of modern sustainable systems and investigates how components' performance limitations affect the utilisation of the whole systems. The third part is a group design activity that involves applying product development process onto a sustainable system - concept generation, design and prediction of performance.

This module is linked with C1, C2, C3, C4, C5, C6, C7, C9, C13, C15, C16, C17 of the AHEP 4.

LO1- C4, C7, C15;
LO2- C1, C4, C6;
LO3- C1, C2, C6, C7;
LO4- C1, C3, C4, C5, C6, C13;

LO5- C1, C2, C3, C6, C13;
LO6- C17;
LO7- C16.

Module web page

Module aims

The main module aim is to equip learners with knowledge and skills necessary to design solutions for complex sustainable energy systems that meet a combination of user, business and customer needs.
The learners will use legislative and technical literature (both internal and external) and then apply the knowledge of engineering principles and design/project management tools and techniques.

The secondary aim is to start developing a systematic approach and an appreciation that engineering problems are often broadly defined.

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.
Regulations (ISO14001 Standard and UN SGDs).
Sustainability in an engineering company;

Sustainable technologies: solar - thermal systems, geothermal systems.
Energy storage: batteries, hydrogen systems.
Thermal systems: air-to-air, air-to-ground.

Product specifications - analysing catalogue data of sustainable components and sub-systems.
Utilisation of photovoltaic system without and with batteries.

Design of systems; project management.
Concept generation and selection of suitable sustainable technologies.
Design & utilisation of space heating systems powered by renewables.

Learning outcomes

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

- Analyse the relationship between internal company documentation and the current legislation in context of sustainability [AHEP:4-C4, C7, C15].
- Identify limitations in product specifications from catalogue data of energy generation and energy storage devices [AHEP:4-C1, C4, C6].
- Compare the performance and the financial benefits of low-power renewable energy systems [AHEP:4-C1, C2, C6, C7].
- Apply engineering design tools and techniques to design a complex sustainable energy system that meets the requirements [AHEP:4-C1, C3, C4, C5, C6, C13].

- Evaluate the performance of the designed sustainable energy system in different conditions [AHEP:4-C1, C2, C3, C6, C13].
- Communicate the findings of your work to technical and non-technical audience [AHEP:4-C17].
- Demonstrate the ability to work as an individual or a team member to achieve shared objectives in a project of work [AHEP:4-C16].

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

- Translate conceptual ideas or technical requirements into developmental outcomes or operational designs or specifications for products, systems or components to solve engineering challenges (S1 in all DA standards).
- Select, use and apply approved problem-solving methods to solve complex problems and determine appropriate solutions or actions (S2 in all DA Standards).
- Collate and use a range of data sources and supporting documentation to support projects (S3 in all DA Standards).
- Interpret and produce technical documentation such as schematic diagrams, project plans, fault reports or data analytics (S4 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, taking into account factors such as safety, quality, cost and performance criteria (S6 in all DA standards).
- Identify resources required to complete projects, project tasks or programmes of work, with consideration to factors such as cost, quality, safety, security, environmental impact as applicable to the activity (S8 in ST0023 and ST0027, S9 in ST0024 and ST0025)
- Create a project or work programme plan and develop activities in a logical process embedding mechanisms for adapting to changing circumstances or requirements (S9 in ST0023 and ST0027, S10 in ST0024 and ST0025).
- Demonstrate leadership when undertaking control system engineering activities such as system design, integration operational simulation (S10 in ST0023 and ST0027, S11 in ST0024 and ST0025)
- Evaluate engineering designs, development or modification options (S13 in ST0027)

Transferable skills

- Sustainability: Understands the climate emergency and committed to an active contribution to a sustainable world.
- Critical Thinking: Make informed decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis.
- Organisational Awareness: Understanding of business, government and third sector issues

and priorities; Awareness of the responsibilities of organisations in society; Understanding organisational norms of behaviour.
- Professionalism: Prepared to operate autonomously; Aware of how to be efficient and resilient; Manages priorities and time; Self-motivated, setting and achieving goals, prioritising tasks.
- Information Literacy: Critical awareness of how information is gathered, used, managed and synthesised; Systematic collection, analysis and evaluation of information in the investigation of a topic.
- Self-awareness: Awareness of personal strengths and emotional intelligence.
- Written communication: Present arguments, knowledge and ideas, in a range of formats
- Problem solving: Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions.
- Teamwork: Operating within, and contributing to, a respectful, supportive and cooperative group climate.

Study

Study time

Type	Required
Lectures	21 sessions of 1 hour (7%)
Seminars	9 sessions of 1 hour (3%)
Work-based learning	30 sessions of 1 hour (10%)
Online learning (scheduled sessions)	30 sessions of 1 hour (10%)
Online learning (independent)	10 sessions of 1 hour (3%)
Other activity	10 hours (3%)
Private study	70 hours (23%)
Assessment	120 hours (40%)
Total	300 hours

Private study description

- Self-guided study: revision on module contents, solution of additional seminar-type questions, video tutorials and supplementary materials.
- Study and use of simulation software.
- Online forum and discussion (asynchronous).

Other activity description

On-line support / consultancy before assessments.

Work-based Learning details of 30 hours is as follows:

- 10 hours in Term 1 for getting familiar with company documents and policies and how they relate to ISO14001 and UN SDGs, for Assessment 1.
- 20 hours in Term 3 for identifying the specifications of the air-conditioning system(s) at workplace that provide specially controlled climate for particular spaces (cold testing chambers, warm testing chambers or computer server rooms).

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time	Eligible for self-certification
Assignment 1	25%	30 hours	Yes (extension)
Individual report containing an analysis of sustainability in the company and in the department apprentices are employed in. Includes linking the company policies and internal documents with ISO14001 and with UN SDGs.			
Assignment 2	25%	30 hours	Yes (extension)
Individual report covering analyses of performance and financial gains of a photovoltaic electricity system with and without battery storage. Every student will have a different set of input parameters and constraints.			
Assignment 3 - Group design project	50%	60 hours	No
Group Report on the design of a sustainable system that includes thermal and electrical sub-systems. Includes project planning, project management, concept generation, component selection and prediction of performance. Typical group size will be 6 students. Will be subjected to Peer-Marking in line with the WMG policy.			

Assessment group R

	Weighting	Study time	Eligible for self-certification
Individual design project	50%		No

	Weighting	Study time	Eligible for self-certification
Individual report on the design of a sustainable system that includes thermal and electrical sub-systems. To include project planning, project management, concept generation, component selection and prediction of performance. To include a short reflection on groupwork during the original module delivery.			
Assignment 1	25%	30 hours	No
Assignment 2	25%	30 hours	No

Feedback on assessment

FORMATIVE FEEDBACK:

- Term 1: automated individual Moodle feedback at on-line tests on ISO14001 and UN SDGs.
- Term 2: cohort-level written feedback on the preliminary analysis performance and financial gains of a photovoltaic electricity system (submitted online after 1 Block of teaching)
- Term 3: cohort-level written feedback on the concept solution for Assessment 3 - submitted by each group leader in early weeks of Term 3. Group-level feedback will be also given to Groups that are identified to be struggling in the online support/consulting sessions.
- verbal feedback given during seminars and revision classes throughout the Y2 (1-to1, group or cohort-level, as appropriate).

SUMMATIVE FEEDBACK:
Written individual feedback on Assessment 1.
Written individual feedback on Assessment 2.
Written group feedback on Assessment 3.

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)