ES4A8-15 Design for Sustainability

24/25

Department
School of Engineering
Level
Undergraduate Level 4
Module leader
Simoni Da Ros
Credit value
15
Module duration
10 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES4A8-15 Design for Sustainability

Module web page

Module aims

Ecological and ‘green’ constraints weigh significantly on engineering designers already and these pressures are likely to increase very significantly during the careers of today’s students. This module examines the need for significant change in the design philosophy employed in industrialised manufacture and civil construction in terms of energy and resource use. It then examines responses to those pressures including legislation and standards, alternative processes and materials and design for resource economy at small and large scale.

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 - understanding definitions of sustainability, what are the key problems, different roles and perspectives of stakeholders

Energy - role of energy generation in industry, transportation and domestic use cases
Materials - sustainability in use of metals, polymers and composite materials
Design - how bad design prevents usage, design in construction, disassembly, repair, recycling
End of life - recycling and the circular economy, looking at metals, polymers, glass and paper
Assessment - life cycle assessment and life cycle costing

Learning outcomes

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

- Demonstrate advanced understanding of the significance and importance of material resource and energy limitations to professional design engineers. (M5, M7)
- Systematically apply lower energy and resource demanding materials and technologies for small scale products and large scale projects. (M5, M6, M7)
- Critically assess the significance of environmental law and other standards for large and small businesses. (M7, M15)
- Evaluate the environmental impact of engineering decisions on factors such as global warming (M1, M7, M13, M15)
- Show systematic understanding of the effect of location, orientation and form on environmental economies, adaptability and flexibility of use or reuse. (M7)

Indicative reading list

Sustainability in Engineering Design. Johnson A, Gibson A. Elsevier 2014. ISBN 9780080993690.
Engineering for Sustainability: A Practical Guide for Sustainable Design. Jonker G, Harmsen J. Elsevier 2012. ISBN 9780444538475.
Sustainability in Engineering Design and Construction. Yates JK, Castro-Lacouture D. CRC Press 2015. ISBN 9781498733915.
Green Building with Concrete: Sustainable Design and Construction. Sabnis GM. CRC Press 2015. ISBN 9781498704106.
Sustainability Engineering: A Design Guide for the Chemical Process Industry. Perl J. Springer 2016. ISBN 978-3-319-32495-1.
Design for Sustainability: a practical approach for Developing Economies. Crul MRM, Diehl JC (eds). CPC 2006. Free download: https://wedocs.unep.org/handle/20.500.11822/8720
EcoDesign. Barbero S, Cozzo B, Tamborrini P. H.F.Ullmann 2012. ISBN: 9783833163081.
Design and Environment - a global guide to designing greener goods. Lewis H, Gertsakis J. Greenleaf. 2001.
ISO 14001 - case studies and practical experiences. Hillary R (ed). Greenleaf 2001.
Green Biorenewable Biocomposites: From Knowledge to Industrial Application. Thakur VK, Kessler M. CRC Press 2015. ISBN 9781771880329.
Bio-Based Plastics: Materials and Applications. Kabasci S (ed). Wiley 2013. ISBN 9781119994008.
Introduction to Peak Oil. Bentley R.W. Springer 2016. ISBN 978-3-319-26372-4.
Sustainable Energy – without the hot air. MacKay D. UIT Cambridge 2009. ISBN-10: 0954452933. ISBN-13: 978-0954452933. Free download: https://www.withouthotair.com/
Our renewable future; Laying the path for one hundred percent clean energy. Heinberg R, Fridley D. Island Press 2016. ISBN 978-1610917797.

Energy Beyond Oil. Mobbs P. Matador 2005. ISBN 1905237006.
Sustainable Futures in the Built Environment to 2050: A Foresight Approach to Construction and Development, Dixon T. Connaughton J., Green S (eds), Wiley-Blackwell , 2018, ISBN-10: 111906381.

View reading list on Talis Aspire

Research element

Students are tasked with research on how to improve the sustainability of a product or process of their choice.

Subject specific skills

Sustainable Engineering
Sustainable Design
Materials & Process Selection

Transferable skills

Critical thinking: 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
Communication - Verbal: Communicate orally in a clear and sensitive manner which is appropriately varied according to different audiences.
Communication - Written: Present arguments, knowledge and ideas, in a range of formats.
Teamwork: Operate within, and contribute to, a respectful, supportive and cooperative group climate.
Sustainability: Understands the climate emergency and committed to an active contribution to a sustainable world.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Private study	120 hours (80%)
Total	150 hours

Private study description

120 hours of guided independent learning

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group A3

	Weighting	Study time
Case Study Group Presentation	40%	
Group case study presentation, including peer assessment		
Individual report	60%	
12-page individual report		

Feedback on assessment

Written individual feedback on essay submissions and cohort level feedback on the oral presentation.

Availability

Courses

This module is Core optional for:

- Year 4 of UESA-H219 MEng Civil Engineering with Exchange Year

This module is Optional for:

- Year 4 of UESA-H116 MEng Engineering with Exchange Year
- Year 5 of UESA-H115 MEng Engineering with Intercalated Year

This module is Option list A for:

- Year 4 of UESA-H336 MEng Automotive Engineering
- Year 5 of UESA-H337 MEng Automotive Engineering with Intercalated Year
- Year 4 of UESA-H217 MEng Civil Engineering
- Year 5 of UESA-H218 MEng Civil Engineering with Intercalated Year

- Year 4 of UESA-H114 MEng Engineering
- Year 4 of UESA-HH76 MEng Manufacturing and Mechanical Engineering
- Year 5 of UESA-HH77 MEng Manufacturing and Mechanical Engineering with Intercalated Year
- Year 4 of UESA-H311 MEng Mechanical Engineering

This module is Option list B for:

- Year 4 of UESA-H336 MEng Automotive Engineering
- Year 5 of UESA-H337 MEng Automotive Engineering with Intercalated Year
- Year 4 of UESA-H311 MEng Mechanical Engineering

This module is Option list C for:

- UESA-H311 MEng Mechanical Engineering
    - Year 4 of H311 Mechanical Engineering
    - Year 4 of H30L Mechanical Engineering with Automotive Engineering
    - Year 4 of H30M Mechanical Engineering with Robotics
    - Year 4 of H30N Mechanical Engineering with Systems Engineering
- Year 4 of UESA-H316 MEng Mechanical Engineering
- Year 4 of UESA-H318 MEng Mechanical Engineering with Exchange Year
- Year 5 of UESA-H317 MEng Mechanical Engineering with Intercalated Year