

## SUSTAINABLE PRODUCT LIFECYCLE ENGINEERING

22WSD407

Semester 2 2023

In-Person Exam paper

This examination is to take place in-person at a central University venue under exam conditions. The standard length of time for this paper is **2 hours**.

You will not be able to leave the exam hall for the first 30 or final 15 minutes of your exam. Your invigilator will collect your exam paper when you have finished.

### Help during the exam

Invigilators are not able to answer queries about the content of your exam paper. Instead, please make a note of your query in your answer script to be considered during the marking process.

If you feel unwell, please raise your hand so that an invigilator can assist you.

You may use a calculator for this exam. It must comply with the University's Calculator Policy for In-Person exams, in particular that it must not be able to transmit or receive information (e.g. mobile devices and smart watches are **not** allowed).

## SUSTAINABLE PRODUCT LIFECYCLE ENGINEERING (22WSD407)

Semester 2 2023

2 Hours

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Answer **ALL three** questions.

Any University-approved calculator is permitted.

All questions carry equal marks.

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1. A full Life Cycle Assessment (LCA) can be time consuming, costly and is reliant on information about the product being available. Streamlined Life Cycle Assessment (sLCA) has become popular as an alternative, especially in the early stages of design such as concept selection:
- a) Explain how the Environmental Responsible Product Assessment (ERPA) Matrix could be used to evaluate concepts during the initial concept evaluation stage [5 marks]
  - b) Describe **three** actions/methods you could use to increase the accuracy of the results obtained using the ERPA matrix. [3 marks]
  - c) Eco-Indicator 99 is another sLCA method. Using a diagram, compare its three phases with the four phases of the ISO14040 Framework and explain why, unlike the ISO14040 framework, it is not presented as an iterative process. [6 marks]
  - d) Water Footprinting is a single impact sLCA method. Explain the difference between the **three** categories of water; Green, Blue and Grey, as used in this method. [6 marks]

2. There are three types of ISO Labels (I, II, and III) for which the standards ISO14024, ISO14021 and ISO14025 apply respectively.
- a) Considered to be the Gold standard of eco labelling; Type 1 labels are mainly used on products to communicate their environmental 'credentials' to the consumer. Give **one** example of a Type 1 label and explain why it has or has not been effective. [6 marks]
  - b) An Environmental Product Declaration (EPD) is developed from an LCA using the appropriate Product Category Rules (PCR). With the aid of a diagram explain the process of creating an EPD. [8 marks]
  - c) EPDs are popular in the construction industry. Give **three** advantages that EPDs offer builders of low impact homes. [6 marks]
3. For energy using products such as a coffee machine, a significant percentage of the life cycle impact typically occurs during the 'use phase'. Describe the following two 'Design for X' methods and provide three examples of how the application of guidelines in each method (i.e. total of six examples) could be used to reduce the negative environmental impacts associated with energy consumption during the use phase of a coffee machine.
- a) Design for Energy Minimisation [10 marks]
  - b) Design for Sustainable Behaviour [10 marks]

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