Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Higher level
Paper 3

12 May 2023

Zone A afternoon | **Zone B** morning | **Zone C** afternoon

Candidate session number

1 hour 30 minutes

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[40 marks]**.

2223 – 6204

12 pages

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

1. EcoHelmet, by Isis Shiffer, is a folding, recyclable helmet designed and marketed for bicycle share users. It is made of biodegradable waterproof paper in a radial honeycomb pattern, see **Figure 1** and **Figure 2**. The EcoHelmet is purchased from a vending machine at the same location as the hire bicycles, requires no assembly and is fully recyclable.

Figure 1: A folded and unfolded EcoHelmet

Figure 2: Demonstration of the EcoHelmet

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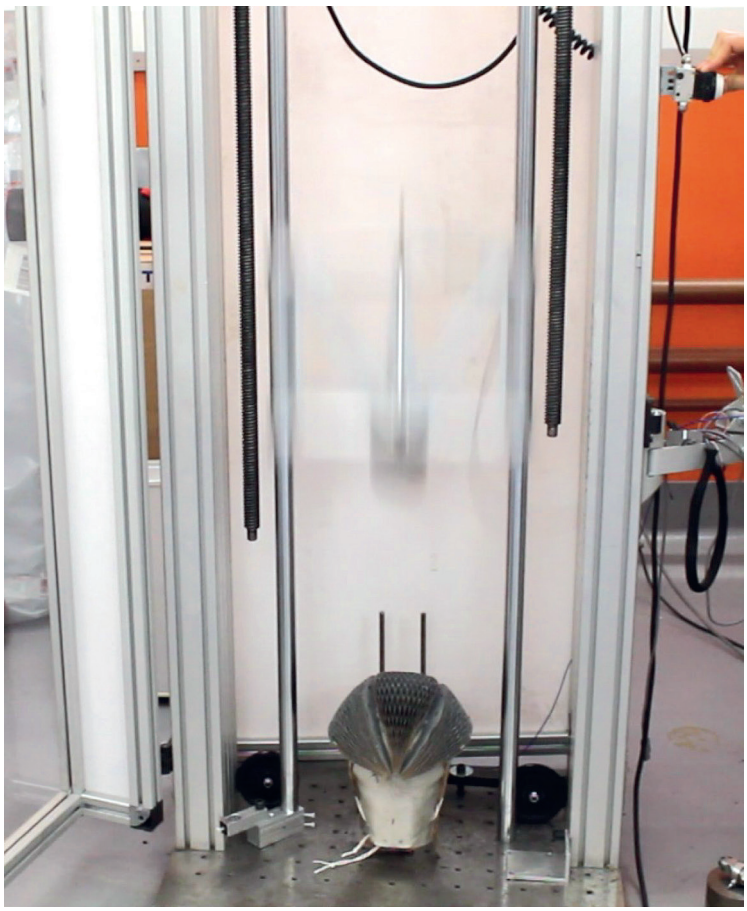
(Question 1 continued)

The EcoHelmet is as functionally effective as a traditional helmet. The prototypes were thoroughly tested in both usability labs and field trials, see **Figure 3**, and passed safety standards in a number of countries.

Figure 3: Testing the EcoHelmet in a usability lab



The materials used in the EcoHelmet make it possible for the helmet to be sold for less than US$5.

(a) The market sector for the EcoHelmet is based on rideshare cyclists.

List **two** market segments used to determine the target audience for the EcoHelmet. [2]

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(Question 1 continued)

(b) The marketing mix includes product, place, price and promotion.

Outline how price is used to enhance market potential for the EcoHelmet. [2]

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(c) Outline **one** advantage of using field research rather than a usability lab in the development of the EcoHelmet. [2]

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(d) Explain why quality assurance is important in the production of the EcoHelmet. [4]

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2. Mycelium, or the vegetative part of a mushroom, is a cheap and sustainable material that can be used in a number of ways. It is currently being used as a packaging material, a plant-based protein food alternative, in skincare products and in the textiles industry. Mycelium is a fully biodegradable material with a minimal carbon footprint.

British designer Sebastian Cox's "Mycelium + Timber" has created the mycelium lamp, see **Figure 4**. The mycelium lamp is sustainably produced and entirely compostable.

Figure 4: Sebastian Cox's Mycelium + Timber lamps

The mycelium lamps take between 4–12 weeks to "grow" and are made using craft production techniques, see **Figure 5**.

Figure 5: Mycelium being used to make the lamp

(a) List **two** of Datschefski's five principles of sustainable design that would be relevant to the concept of the mycelium lamp. [2]

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(Question 2 continued)

(b) Outline **one** way in which the mycelium lamp promotes the idea of sustainable consumption. [2]

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(c) Suggest **two** corporate strategies designers could use when innovating with mycelium. [6]

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Section B

Read the case study. Answer the following question. Answers must be written within the answer boxes provided.

3. The Swell Surf Foot, see **Figure 6**, by Zachary Samalonis and Yuhan Zhang, is a low-cost, flexible foot designed for amputee surfers that can be attached to existing prosthetic systems. The Swell Surf Foot allows amputees to replicate the flexibility and grip of a human foot to move in ways not possible with current prosthetics.

Figure 6: The Swell Surf Foot

The Swell Surf Foot simulates the natural movement of the ankle. The front section provides flexibility while walking, whilst the rear tread uses surface area to grip on the board, making balancing and the ability to "pop up" on the board easier, see **Figure 7** and **Figure 8**.

Figure 7: Walking on the beach wearing the Swell Surf Foot

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(Question 3 continued)

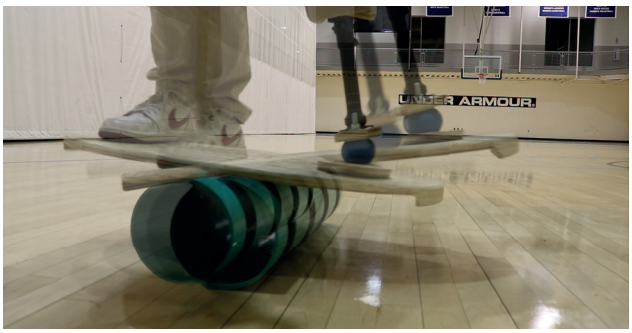
Figure 8: "Popping up" on the board

During the development of the Swell Surf Foot, interviews were conducted with amputee surfers that highlighted many problems with existing solutions. Most affordable prosthetics on the market were found to function poorly and be limited in their use. Swell can be used like a standard shoe, allowing it to be used when walking.

Samalonis and Zhang developed an "empathy rig" by modifying a medical boot to replicate the feeling of a prosthetic foot and testing a variety of potential solutions on treadmills and balance boards with amputee surfers, see **Figure 9** and **Figure 10**. Volunteers provided feedback by trialling different models before taking the Swell Surf Foot out into the water for final testing.

Figure 9: User testing the Swell Surf Foot with an "empathy rig"

Figure 10: Trials conducted on a balance board



The price of the most basic version of the Swell Surf Foot is US$65. The price of the closest competitor product is US$150. By offering a prosthetic device that enables individuals to participate in a new sport at a low cost, Swell aims to promote itself against other products on the market.

Surfing is a worldwide sport that has gained popularity over several decades and was included in the 2020 Olympics. It is hoped that adaptive surfing will be included in the 2028 Paralympic Games.

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(Question 3 continued)

(a) Outline why the retail price of US$65 for the Swell Surf Foot makes it economically viable for production. [2]

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(b) Outline **one** reason why a just in time (JIT) strategy would be used for the production of the Swell Surf Foot. [2]

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(c) Outline how the Swell Surf Foot provides physio-pleasure for its user. [2]

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(Question 3 continued)

(d) Suggest how the inclusive nature of the Swell Surf Foot satisfies the social **and** economic aspects of triple bottom line sustainability. [5]

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(Question 3 continued)

(e) Explain how user-centred design (UCD) could be used to gain an understanding of the user, the task **and** the environment in the development of the Swell Surf Foot. [9]

References:

Figure 1 With permission from Spitfire Industry.

Figure 2 With permission from Spitfire Industry.

Figure 3 With permission from Spitfire Industry.

Figure 4 Images with permission from Sebastian Cox Ltd.

Figure 5 Images with permission from Sebastian Cox Ltd.

Figure 6 Swell Surf Foot; Images with permission from Zachary Samalonis and Yuhan Zhang.

Figure 7 Swell Surf Foot; Images with permission from Zachary Samalonis and Yuhan Zhang.

Figure 8 Swell Surf Foot; Images with permission from Zachary Samalonis and Yuhan Zhang.

Figure 9 Swell Surf Foot; Images with permission from Zachary Samalonis and Yuhan Zhang.

Figure 10 Swell Surf Foot; Images with permission from Zachary Samalonis and Yuhan Zhang.

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