2022.M104A

2022L065A1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

# Leaving Certificate Examination 2022

# Technology

## Section A and Answerbook

## Higher Level

## Monday 27 June Afternoon 2:00 - 4:30

136 marks

**Examination Number**

**Day and Month of Birth**

For example, 3rd February is entered as 0302

**Centre Stamp**

The 2022 examination papers were adjusted to compensate for disruptions to learning due to COVID-19. This examination paper does not necessarily reflect the same structure and format as the examination papers of past or subsequent years.

## Instructions

Write your Examination Number and your Day and Month of Birth in the boxes on the front cover.

Write your answers to all parts of the examination into this answerbook. This answerbook will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Write your answers in blue or black pen. You may use pencil for sketches, graphs and diagrams only.

There are three sections to this examination. Attempt **all three** Sections.
Questions for Sections B and C are supplied separately but your answers must be written in this answerbook.

**Section A** 72 marks
Core – Short-answer questions.
Answer **any twelve** questions in this section.
Each question carries 6 marks.

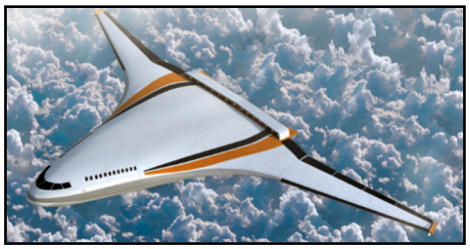
**Section B** 24 marks
Core – Long-answer questions.
Answer **one** of the two core questions presented.
Each question in Section B carries 24 marks.

**Section C** 40 marks
Options – Long-answer questions.
Answer **one** of the five optional questions presented.
Each question in Section C carries 40 marks.

# Section A.

Answer **any twelve** questions. All questions carry 6 marks.
**Write your answers in the spaces provided.**

**1.** NASA are constantly striving to build efficiency into all phases in the design of aircraft, including development, manufacture and operation sequences.



Outline **two** challenges when trying to enhance the design of next generation aircraft.

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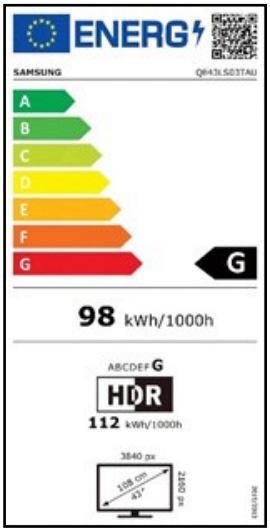
**2.** On the 1st March 2021, a new rescaled energy label was introduced for products such as household refrigerators and freezers, washing machines, televisions, and electronic displays.




Outline **two** important pieces of energy information that the television label shown conveys to the consumer.

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| 1. |
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| 2. |
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**3.** Outline an action for **each** of the following features of sustainable development, using the management of water resources as a theme:

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| Environmental: |
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| Economic: |
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| Social: |
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**4.** Since the start of 2021, Bus Eireann has introduced *hybrid* buses to their fleet and will continue to do so over the next few years.

**(i)** Explain what is meant by the term *hybrid*.

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**(ii)** Outline **two** advantages of using hybrid buses over diesel-powered buses.

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| 1. |
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**5.** **(i)** Explain the function of the tolerance band on the resistor shown.


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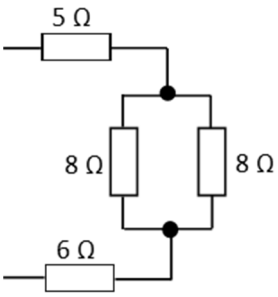
**(ii)** Calculate the total resistance of the circuit shown.

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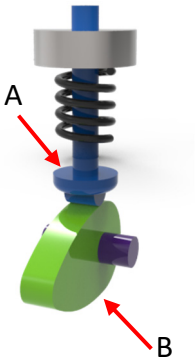
| Calculation: |

**6.** The graphic shows a mechanism which consists of two components, labelled **A** and **B**.

**(i)** Name component **A** and component **B**.

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| A: |
| B: |

**(ii)** Outline the operation of the mechanism shown, referring to the movement changes and the spring.

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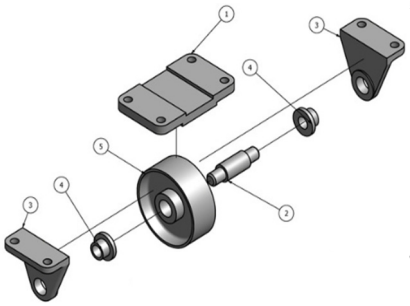
**7.** The image shows a bridge under construction.
Compile a Gantt chart for the construction of a **typical** bridge.

**8.** An exploded view of a castor wheel is shown.

Sketch a pictorial view of the assembled castor wheel.



**9.** Two computer devices used to store data are shown.

**(i)** Explain the following terms:

| |
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| SSD: |
| HDD: |

**(ii)** Compare SSD and HDD in terms of *price*, *speed,* and *storage*.

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**10.** Risk assessment is a critical element in providing a safe environment in a school workshop. Complete the partial risk assessment guide, shown below, for the use of a soldering iron.

**Risk Assessment – Technology Room – Soldering iron**

| Hazards | Is the hazard present? Y/N | What is the risk? | Risk rating H = High M = Medium L = Low | Control measures | Is this control in place? Y/N |
|---|---|---|---|---|---|
| Hot soldering iron | Y | Burns | H | Use soldering iron stand.<br>Warning signs present. | Y<br>Y |
| Damaged power lead | Y | | | | |
| Fumes | Y | | | | |

**11.** Briefly describe how Bluetooth technology can be used in **each** of the following tasks:

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| Data transfer: |
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| Wire-free control: |
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| Tethering: |
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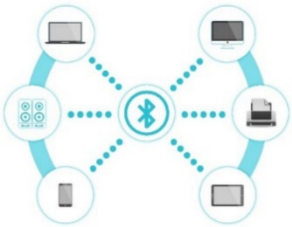
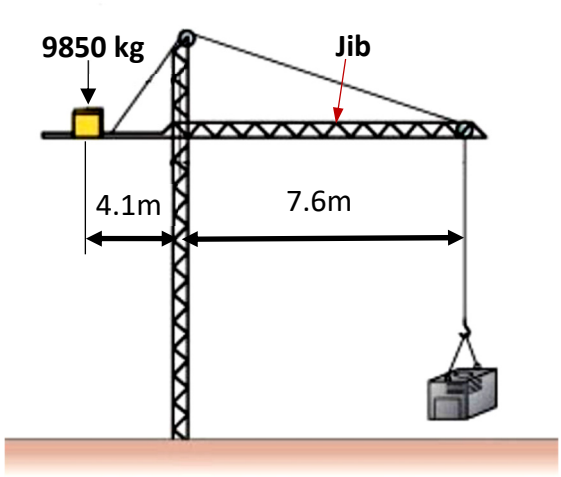


**12.** The arm (jib) of a tower crane is 7.6 m in length. A counterweight of 9850 kg is placed at 4.1 m, as shown.

**(i)** Calculate the maximum load that can be lifted by the crane using this counterweight. (Ignore the mass of the beam.)

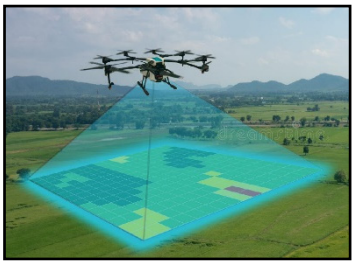



Calculation:

**(ii)** Explain what is meant by the term *triangulation*.

**13.** In recent years, data capture drones have become very popular.

**(i)** Name **one** application where drones could be used for data capture.



**(ii)** State **one** positive aspect and **one** negative aspect of using drones for data capture.

| Positive: |
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| Negative: |
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**14.** Planet Sustie is an Irish company that supplies 100% compostable, sustainable, and *biodegradable* partyware and tableware.

**(i)** Explain the term biodegradable.


**(ii)** Outline **one** advantage and **one** disadvantage of using biodegradable plates and cups.

| Advantage: |
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| Disadvantage: |
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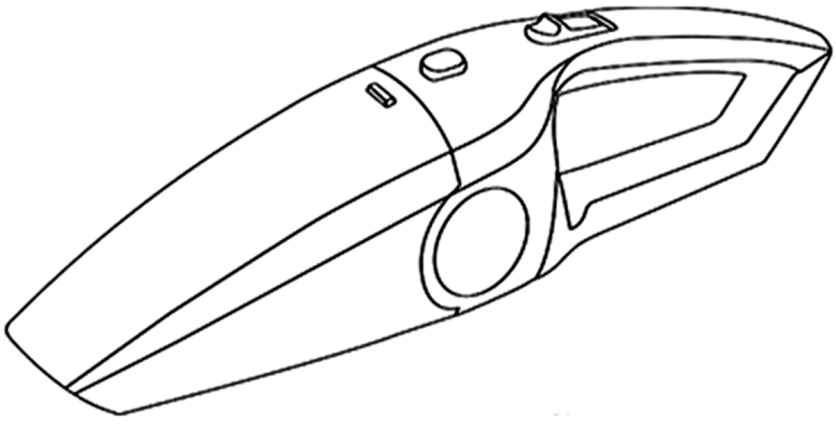
**15.** Use **two** graphic techniques to enhance the representation of the handheld vacuum cleaner shown.



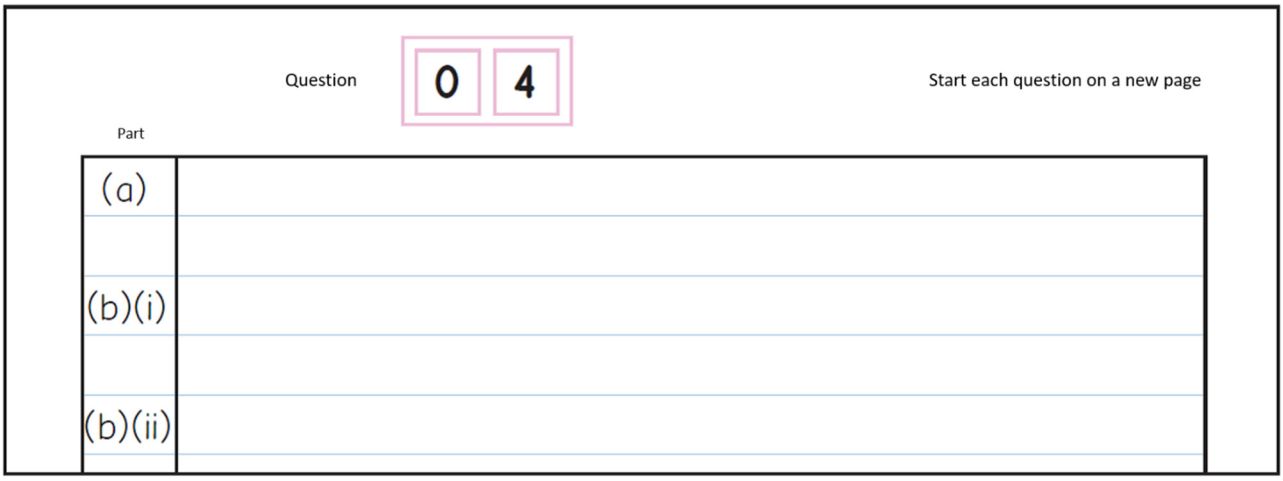
# Answerbook for Sections B and C

## Instructions

Questions for **Sections B** and **C** are supplied separately.

Start each question on a new page. Write the question number in the box at the top of each page.

Use the left-hand column to label each part, as shown below.




You do not need to use all of the pages in this answerbook. If you run out of space in this answerbook, you may ask the superintendent for more paper.

Write your answers in blue or black pen. You may use pencil for sketches, graphs, and diagrams only.

Question

Start each question on a new page

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**Acknowledgements**

**Images**
Image 1 page 3: https://www.nasa.gov/sites/
Image 2 page 3: https://www.flatpanelshd.com/
Image 3 page 3: https://mcwaneinc.files.wordpress.com/
Image 1 page 4: https://colombiabus.com.co/
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Leaving Certificate – Higher Level

# Technology Section A and Answerbook

Monday 27 June

Afternoon 2:00 - 4:30

2022.M104BC

2022L065A2EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

# Leaving Certificate Examination 2022

# Technology

## Section B and Section C

## Higher Level

## Monday 27 June Afternoon 2:00 - 4:30

136 marks

**Instructions**

**Section B** 24 marks
Core- Long-answer questions.
Answer **one** of the two core questions presented.
Each question in Section B carries 24 marks.

**Section C** 40 marks
Options- Long-answer questions.
Answer **one** of the five optional questions presented.
Each question in Section C carries 40 marks.

THESE QUESTIONS ARE TO BE ANSWERED IN THE ANSWERBOOK ATTACHED TO **SECTION A.**

Do not hand this up.

This document will not be returned to the State Examinations Commission.

The 2022 examination papers were adjusted to compensate for disruptions to learning due to COVID-19. This examination paper does not necessarily reflect the same structure and format as the examination papers of past or subsequent years.

# Section B - Core - *Answer Question 2 **OR** Question 3*

**Question 2** - *Answer 2(a) **and** 2(b)*

**2(a)** Robots can use ultraviolet (UV) technology to disinfect settings such as hospitals and schools to minimise exposure to COVID-19. These robots are equipped with multiple sensors and an array of powerful short wavelength ultraviolet-C (UV-C) lights.

UV-C light sanitiser system in a classroom

**(i)** Describe **two** other ways in which technology can help prevent the spread of infectious diseases.

**(ii)** State **two** other applications where UV light is used in everyday life.

**2(b)** The base of the Adibot UV-C robot, shown, is equipped with intelligent safety features that incorporate sensor technology.


**(i)** Outline **two** reasons for the use of intelligent safety features in this robot**.**

**(ii)** Suggest **one** sensor that could be used in the base of the robot. State the purpose of this sensor.

**(iii)** Describe, using an annotated sketch, a suitable steering system for the robot.

*Answer 2(c) **or** 2(d)*

**2(c)** In an ever-advancing technological world, products are replaced very quickly.

**(i)** Describe, using a labelled diagram, a typical product life cycle for the Adibot robot, shown in ***2(b)*** above.

**(ii)** Outline **two** ways in which a product such as the Adibot could be marketed to boost sales.

**OR**

**2(d)** The strength of materials may be enhanced by a range of different techniques including fibre-reinforcement and lamination.

Laminated phone screen with fibre-reinforced cover

**(i)** Describe, with specific examples, how the properties of plastic materials are improved through fibre-reinforcement.

**(ii)** Outline the process of lamination in glass products.

**Question 3** - *Answer 3(a)* ***and*** *3(b)*

**3(a)** Urban Movement® is an e-scooter brand developed by Stephen Woods from Dublin. The scooter shown in ***3(b)*** below offers a sleek black exterior, 270 W motor power, honeycomb wheels and a long-lasting battery.

**(i)** Suggest **one** advantage and **one** disadvantage of using e-scooters for transport in cities.

**(ii)** Outline **two** ways in which the comfort of the user has been enhanced in the e-scooter shown.

**3(b)** This Urban Movement® e-scooter is designed to fold for ease of storage and has a removable battery.

**(i)** Describe, using an annotated sketch, a method of folding the frame of the scooter.

**(ii)** Draw a circuit diagram that will automatically switch on a flashing LED cluster light on the scooter after dark.

**(iii)** Suggest **two** pieces of data that may be shown on the electronic display of a scooter.


*Answer 3(c)* ***or*** *3(d)*

**3(c)** A rechargeable battery is used to operate an e-scooter, whereas capacitors can be used for camera flashes and motor starting.

**(i)** Compare a capacitor and a battery as storage devices, in terms of energy storage, charging time, and recharging capacity.

**(ii)** The voltage (V) of a battery is 12 V. The voltage drop ($V_f$) across an LED cluster is 2 V and the maximum current that the LED cluster can draw is 20 mA.
Calculate the minimum value of the resistor required to protect the LED cluster.

**OR**

**3(d)** Vehicles, such as the Urban Movement® e-scooter, above, must be manufactured to the highest standards to ensure that they are safe and reliable.
*Conformance* and *durability* are two of the dimensions used to describe the quality of an item.

**(i)** Explain what is meant by **each** of the terms, *conformance*, and *durability*.

**(ii)** Name the **four** stages of the continuous improvement model known as the Deming cycle.

# Section C - Options - *Answer **any one** of the five optional questions.*

## Option 1 - Applied Control Systems - *Answer 1(a) **and** 1(b)*

**1(a)** *Recommender systems* provide personalised service support to users by learning previous behaviours and predicting current preferences for products or services.

**(i)** Suggest **two** applications of recommender systems.

**(ii)** Outline **one** benefit and **one** negative consequence of recommender systems for the consumer.

**1(b)** A graphic of a desktop printer is shown. Its operating sequence is outlined as follows:

- After the power is turned on, the fuser temperature and the toner level are checked
- A flashing red LED is turned on if paper is not available
- Once these initial checks have been completed, the printer roller pulls the sheet through the printer
- If the paper jams as it goes through the printer, a buzzer will sound
- The finished sheet is ejected.

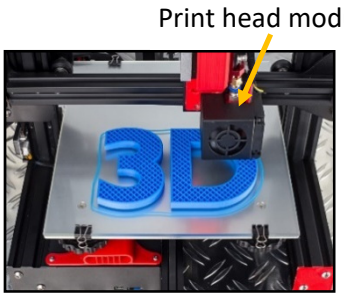
**(i)** Draw a flowchart for the operating sequence of the printer.

**(ii)** Suggest a modification to the flowchart to include a command that will count the number of sheets printed.

**(iii)** Suggest an electronic means of determining how much toner is left in the printer cartridge.

*Answer 1(c) **or** 1(d)*

**1(c)** The 3D printer, shown, uses a *Cartesian co-ordinate system* to determine the correct position and direction of the print head.

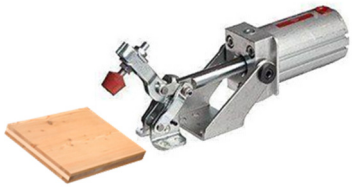



**(i)** Describe, using annotated sketches, what is meant by a *Cartesian co-ordinate system*.

**(ii)** State **two** reasons for the use of stepper motors in the control of movement of the print head.

**OR**

**1(d)** A pneumatic clamp is used to hold down wooden parts that have been glued together.



**(i)** Draw a pneumatic circuit diagram for the operation of the double-acting cylinder used in the clamp.

**(ii)** Suggest a means of reducing the speed of clamping to avoid damage to the wood.

## *Option 2 - Electronics and Control* - *Answer 2(a) **and** 2(b)*

**2(a)** Electromagnetic solenoids are transducer devices used to change one form of energy to another, i.e., electrical energy into mechanical energy.

**(i)** Outline the operation of the electromagnetic solenoid shown.

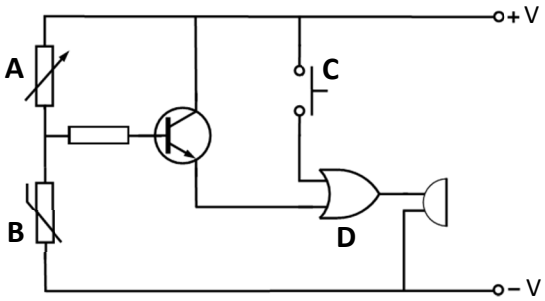
**(ii)** Suggest **one** use for a solenoid in everyday life.

**2(b)** A heat alarm with logic gate processing is shown in the circuit diagram.

**(i)** Describe how this logic gate circuit operates. Refer to the components **A**, **B**, **C**, and **D** used in the circuit.

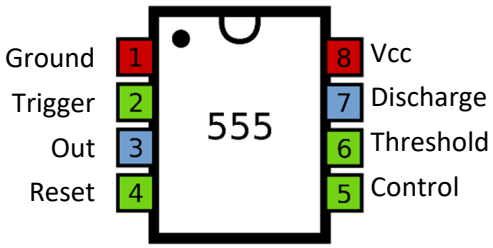
**(ii)** Draw a truth table for the logic gate shown.

**(iii)** Outline how the circuit could be made more responsive to changes in temperature.




*Answer 2(c) **or** 2(d)*

**2(c)** The 555 timer is an integrated chip used in a variety of timer, pulse generation and oscillator applications.




**(i)** Explain the function of the *trigger*, *discharge,* and *threshold* pins on the 555 timer.

**(ii)** Draw the circuit configuration of the 555 timer in *astable* mode.

**OR**

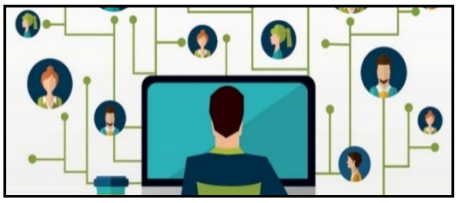
**2(d)** A plant terrarium or reptile vivarium tank needs to control temperature levels carefully. A circuit involving a *Darlington Pair* transistor with a *relay* may be used for this purpose.

**(i)** Draw a circuit diagram with an appropriate input, *Darlington Pair* transistors, and suitable output for temperature control of the vivarium.

**(ii)** Suggest a purpose for a *relay* in a transistor control circuit.

## *Option 3 - Information and Communications Technology* - *Answer 3(a) **and** 3(b)*

**3(a)** The extensive use of laptop computers while remote working can have a significant impact on health, wellbeing, and safety of employees.



**(i)** Describe **one** impact of digitally working from home on **each** of the following:

- Commuting to work
- Work flexibility
- Employee wellbeing.

**(ii)** Outline the features of a communications software platform used to support virtual meetings.

**3(b)** The high-definition webcam shown features *1080p/60fps fast streaming*, *wide adjustable field of view* and *5 × zoom*. This type of webcam can be used by small businesses for video conferencing with clients.


**(i)** Explain **each** of the elements of the specification given above.

**(ii)** Describe how a 20 GB video file can be shared online.

**(iii)** Outline, using annotated sketches and examples, the differences between *bitmap* images and *vector* images.

*Answer 3(c) **or** 3(d)*

**3(c)** The National Cyber Security Centre (NCSC) is a government organisation with responsibility for cyber security. It protects infrastructure and advises businesses, most notably during the *ransomware* attack on the HSE on 14 May 2021.

**(i)** Explain the term *ransomware*.

**(ii)** Explain **each** of the following cyber security terms:

- Multi-factor authentication
- Encrypted file sharing
- Password manager.

**OR**

**3(d)** **(i)** Distinguish between system software, utility software, and application software.

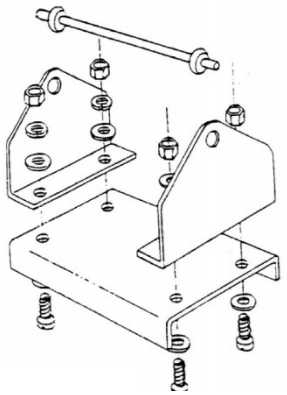
**(ii)** Outline the main features of the following wireless networks:

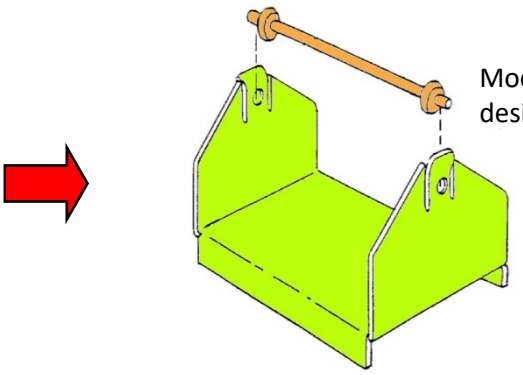
- Wide Area Network (WAN)
- Local Area Network (LAN).

## *Option 4 - Manufacturing Systems* - *Answer 4(a) **and** 4(b)*

**4(a)** Design-for-Assembly (DFA) is a process by which products are designed with ease of assembly in mind. DFA techniques were applied to the modified roll-bar bracket design, as shown below.

Original bracket design





Modified bracket design

**(i)** Explain **each** of the following in relation to DFA:

- Design for fast assembly
- Modular design of products.

**(ii)** Describe a role for computer simulation in DFA prototype design.

**4(b)** An analysis of the production of the *Slant 3D* headphone stand, shown here, has compared the cost of injection moulding of the product versus 3D printing of the product.

**Injection moulding**:
Cost of producing the mould is €6000.
Production cost per stand is €0.20.

***Or***

**3D printing**:
Cost of printing each stand is €0.80.

The company does not include the fixed cost of machines, labour and set-up, which are assumed to be equal for both production methods.

**(i)** Draw a graph to show the cost of manufacturing the headphone stands using each method.

**(ii)** Determine the BEQ (break-even quantity).

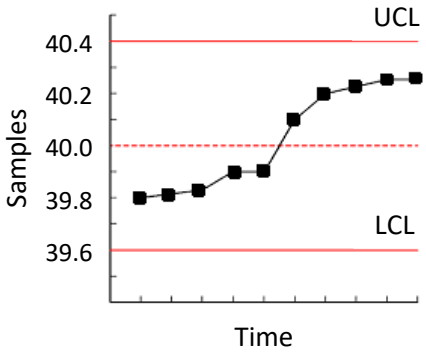
**(iii)** Outline **three** other significant factors to be considered in the decision on how to produce batches of the headphone stands.

**Please turn over** ⟹

# *Option 4 - Manufacturing Systems - continued*

*Answer 4(c)* ***or*** *4(d)*

**4(c)** A production facility introduced a system of control charts to monitor the accuracy of their building blocks product. An example is shown in the graphic below.

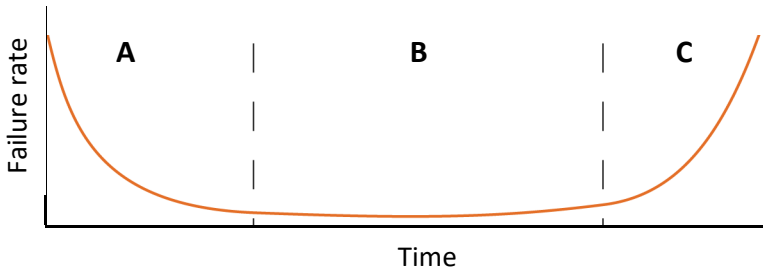



**(i)** Evaluate the process presented in the control chart above and predict if the process is likely to remain in control.

**(ii)** Briefly describe **two** quality control measures a manufacturer can undertake during a production process.

**OR**

**4(d)** The failure rate of a cordless drill product is outlined in the three phases of a 'Bathtub Curve' diagram given below.



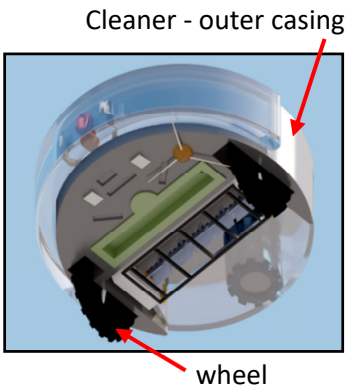

**(i)** Name and describe **each** of the phase's **A**, **B**, and **C**.

**(ii)** A manufacturer is reviewing the design for a cordless drill. Briefly outline:

- An intervention to reduce the failure rate of the drill at stage **A**
- An intervention to reduce the failure rate of the drill at stage **C**.

## *Option 5 – Materials Technology* - *Answer 5(a) **and** 5(b)*

**5(a)** The image shows a robotic vacuum cleaner. A variety of materials are used in the manufacture of the body and the subsystem of the vacuum cleaner.




**(i)** Suggest a suitable metal for the outer casing of the cleaner. Justify your selection.

**(ii)** Outline the environmental impact of the materials used for the wheels in this device.

**5(b)** The top cover of the robotic vacuum cleaner must be able to withstand impacts from collisions with furniture or from a person accidently standing on it.


**(i)** State **two** reasons why destructive testing of materials is carried out during the design phase of devices such as vacuum cleaners.

**(ii)** Describe, using annotated sketches, an impact test to compare the impact properties of different materials that could be used in the manufacture of the cleaner cover.

**(iii)** Describe, using annotated sketches, a means of strengthening materials during their design or production.

*Answer 5(c) **or** 5(d)*

**5(c)** **(i)** Name a suitable thermoplastic material that could be used to manufacture the top cover of the robotic vacuum cleaner, shown in ***5(b)*** above.

**(ii)** Describe, using annotated sketches, a suitable method to manufacture a large batch of the cleaner covers.

**OR**

**5(d)** The earliest commercial development in nylon as a material was undertaken by DuPont in 1927. Nylon is a synthetic polymer generally formed into fibres, film, or extruded shapes.

**(i)** Explain, with **one** example in **each** case, the uses of nylon in fibres, film, and extruded sections.

**(ii)** Describe **two** properties that make nylon suitable for gear wheels.

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**Acknowledgements**

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Leaving Certificate – Higher Level

# Technology Section B and Section C

Monday 27 June

Afternoon 2:00 - 4:30