



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2024
Technology
Section B and Section C
Higher Level

Monday 24 June Afternoon 2:00 - 4:30
160 marks

Instructions

Section B 48 marks

Core - Long-answer questions.

Answer 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**.

Section B - Core - Answer Question 2 **AND** Question 3

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

2(a) Smart Homes use internet-connected devices and systems to enhance functionality.

- (i) Name **three** devices that may be controlled by a home automation system.
- (ii) Explain how energy efficiency might be enhanced with the installation of a home automation system.



2(b) A wall-mounted controller hub for a smart home is shown opposite.

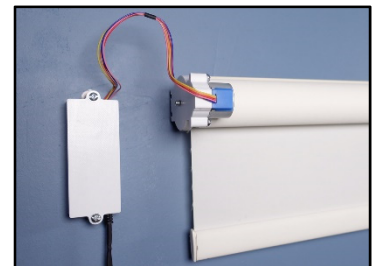
- (i) Describe, with examples, **each** of the following parts of a home automation system:
 - Controller hub
 - Smart lighting and thermostats
 - Sensors and cameras.
- (ii) Explain the terms *user interface* and *Bluetooth*.
- (iii) Outline **two** ways of protecting privacy and data security when using home automation systems.



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

2(c) Roller blinds can be operated automatically using a motor.

- (i) Describe, with annotated sketches, a motorised system to open and close a roller blind.
- (ii) Outline **two** factors that affect the efficiency of a DC motor.



OR

2(d) Devices, such as home automation systems, must be of high quality and be safe to use.

- (i) Explain **any two** of the quality dimensions of *performance*, *conformance*, and *reliability*.
- (ii) Briefly describe **each** of the steps in the Deming Cycle.

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

3(a) In the pursuit of effective high-visibility road safety markings, flexible bollards are increasingly being used to delineate cycle lanes, control parking, or separate vehicles.

- (i) Outline **two** safety benefits of using flexible bollards.
- (ii) Suggest an appropriate plastic material to produce these bollards. Justify your selection.



3(b) The Leaos e-bike has a range of design features including integrated solar charging, carbon fibre handlebars, and an innovative pressed-metal frame.

- (i) Describe the components and operation of a mains-powered charging system **and** of a solar charging system for the e-bike.
- (ii) Outline, using annotated sketches, **two** advantages of producing the bicycle frame by pressing it from sheet metal.
- (iii) Calculate the total energy that a solar panel generates in 4 hours with an output of 50 watts per hour and 15% efficiency.



Leaos e-bike with pressed frame and integrated solar panels

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

3(c) The handlebar 'cockpit' for the e-bike is produced from carbon fibre.

- (i) Outline **two** reasons for using carbon fibre for the handlebars.
- (ii) Compare the manufacture of tubular handlebars and carbon fibre handlebars making reference to fabrication, integration of features, and aesthetic appeal.



OR

3(d) Bicycle user safety is largely dependent on the use of a helmet. A prototype helmet which has safety and cyclist assistance technologies including LIDAR, face shield, LED lighting, and communication capabilities is shown.

- (i) Discuss the contribution to user safety of **any two** features of the prototype helmet.
- (ii) Outline **two** advantages of 3D printing as a production method for the shock absorbing inner liner of the helmet.



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

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

1(a) The Internet of Things connects and controls devices. The Internet of Behaviours (IoB) extends the capabilities of the internet of things (IoT) by analysing behaviour as well as connecting devices and collecting data from individual *digital footprints*.

- (i) What is a digital footprint?
- (ii) Suggest **two** sources of data for the IoB.

1(b) The animal deterrent shown is used to scare pests away from gardens. It operates as follows:

- Power on to activate motion sensor
- Check movement
- Turn on red LED
- Turn on sound
- Wait 60 seconds
- Check movement
- Turn off red LED and sound.



- (i) Draw a flowchart for the operating sequence of the deterrent.
- (ii) Suggest a modification to the flowchart that will turn on a water sprinkler if motion is detected more than once.
- (iii) Suggest an electronic means of producing a deterrent sound.

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

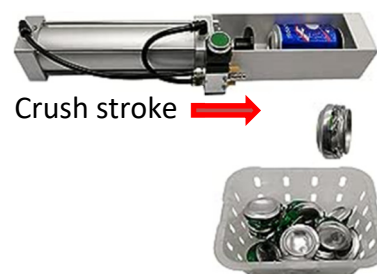
1(c) CAD/CAM software generates G-codes and M-codes to control CNC machines.

- (i) Explain the terms CAD, CAM, and CNC.
- (ii) Outline the operation of a closed-loop control system.

OR

1(d) The device shown crushes aluminium cans using a 5/2 valve to control the pneumatic cylinder.

- (i) Draw a pneumatic circuit diagram to control the movement of the two-way pneumatic cylinder.
- (ii) Outline a method of slowing the outward crushing stroke yet still allowing full speed on the return stroke.



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

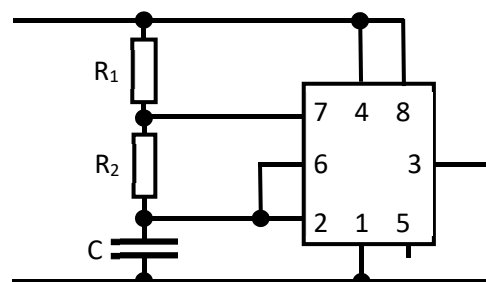
2(a) Wireless chargers work on the principle of electromagnetic induction.

- Outline the operation of the wireless charger shown.
- Suggest **two** benefits of wireless charging of devices.



2(b) An incomplete circuit diagram for an astable warning sounder is shown.

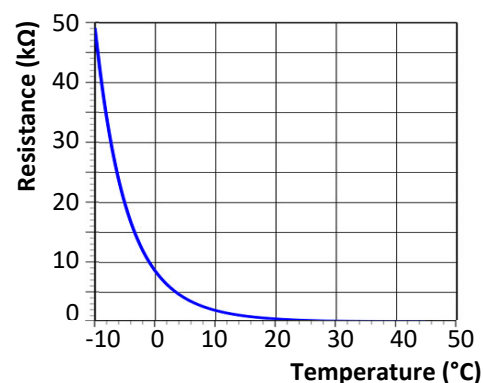
- Redraw the circuit diagram to include an appropriate output.
- Calculate the frequency of the output if $R_1 = 10 \text{ k}\Omega$, $R_2 = 60 \text{ k}\Omega$ and $C = 10 \text{ }\mu\text{F}$.
Note: $f = 1.44 / (R_1 + 2R_2) \times C$
- Describe, with annotated sketches, the process of soldering a printed circuit board (PCB) for the circuit shown. Make reference to a means of protecting the IC and best practice for safe soldering in a school workshop.



Answer 2(c) or 2(d)

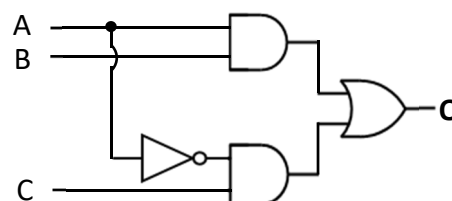
2(c) The characteristic curve of a thermistor is shown.

- State the approximate resistance of this thermistor at 0°C .
- Explain why this thermistor has an effective range between -10°C and 20°C .



OR

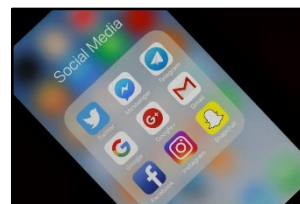
- Draw a truth table to represent the operation of the logic gate system shown with **O** as the output.
- Outline the function of transistors **and** relays when constructing logic circuits.



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

3(a) Soccer star Cristiano Ronaldo as well as celebrities like Kylie Jenner and Selina Gomez have established a reputation as social media influencers.

- (i) Outline **one** benefit and **one** drawback of social influencing.
- (ii) Explain the social media influencer terms; *reels*, *endorsements*, and *affiliate links*.



3(b) The specification for the Samsung Galaxy S22 ultra smartphone includes fast charging, expandable storage and a quad camera featuring an LED flash, auto-HDR which will take 4K videos at 30/60 fps and 8K videos at 24 fps.

- (i) Explain the phone feature *4K videos at 30/60 fps*.
- (ii) Describe, with examples, **each** of these phone protection systems:
 - Secure enclave for biometric data
 - Secure communication protocols
 - Remote tracking and wiping.
- (iii) Outline **two** advantages of data transfer using USB Type-C.



Answer 3(c) or 3(d)

3(c) Secure connection to the internet is extremely important when carrying out financial transactions online or using banking apps.

- (i) Explain **each** of the following in relation to secure connections:
 - Data encryption
 - VPN
 - Multiple firewalls.
- (ii) Explain the term *network eavesdropping* and the possible consequences for a business.

OR

3(d) (i) Online advertising commonly incorporates images, video, and sound. Give a typical file extension for **each** of the elements listed above.

- (ii) Outline the function of **any two** of the following types of server:
 - Domain Controller
 - File Server
 - Application Server.

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

4(a) An Irish company, The Laser Lab® has developed a business laser cutting and engraving on a wide variety of materials and products, such as the personalised presentation shown.

(i) Explain how companies use the following techniques in the development of new products for market:

- Perceptual mapping
- Capacity planning.



(ii) Distinguish between an *order qualifier* and an *order winner* when a company is developing a product.

4(b) A rugby club wishes to purchase 50 personalised trophies, similar to those shown below, for their annual awards.

(i) Distinguish between once-off, batch, and mass production, and state which system of production is most appropriate for fulfilling this order.

(ii) A decision must be made on whether to assemble the trophies using skilled labour or use an automated process.

Option A – Use skilled labour to assemble:
Cost: €8.50 per unit to assemble.

Option B – set up an automated assembly process:
€500 set up cost for automated assembly machine.
Cost: €0.15 per unit to assemble.



Using the information above, draw a graph to show the cost of assembling the trophies using option A and option B.

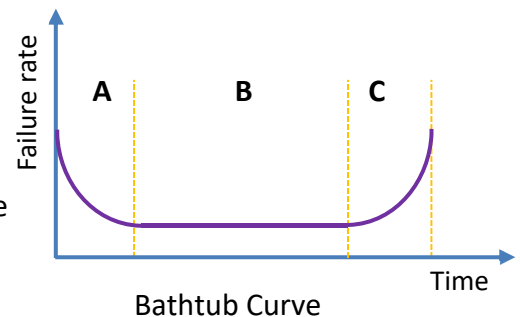
(iii) Determine the BEQ (break-even quantity) and recommend the most suitable assembly method for the product.

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Option 4 - Manufacturing Systems -continued

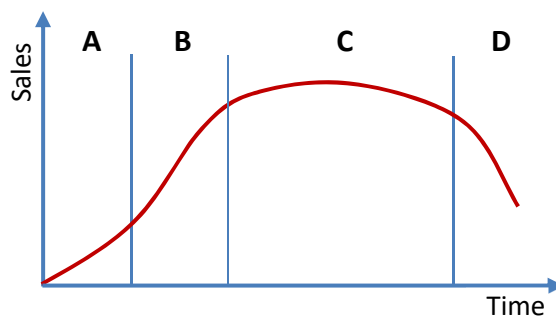
Answer 4(c) or 4(d)

- 4(c) (i) Outline, with examples, the difference between quantitative accelerated testing and qualitative accelerated testing.
- (ii) Explain **each** of the main stages of the 'bathtub' curve making reference to product reliability at each stage.

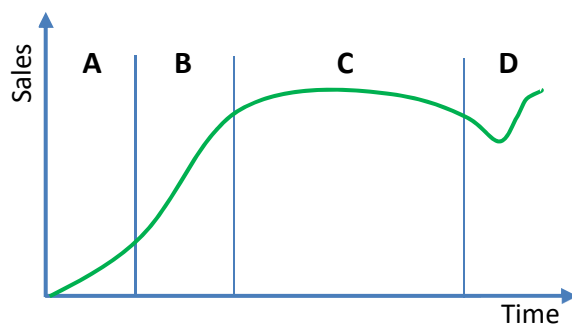


OR

4(d) The expected product lifecycle for a hair styling product is shown.



- (i) Name and describe **each** of the lifecycle stages A, B, C, and D.



- (ii) An updated lifecycle for the hair styling product is shown above. This shows a significant change at stage D for the product. Suggest **two** possible reasons for this change.

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

5(a) Barry Packaging is an Irish family-owned company that celebrated 50 years in business in 2023. They design and supply a wide range of branded packaging from storage boxes to luxury gift bags.

- (i) State **two** reasons for using branded packaging.
- (ii) Outline **two** reasons for the extensive use of corrugated cardboard in the packaging industry.



5(b) Shown is a barcode optical scanner used in the retail industry to read printed barcodes. The scanner is made from the thermoplastic high impact polystyrene (HIPS).

- (i) Distinguish between thermoplastics and thermosetting plastics.
- (ii) Describe, with annotated sketches, a suitable mass production method to produce the outside casing of the barcode scanner.
- (iii) Outline **two** plastic additives which might be used when producing the scanner.



Answer 5(c) or 5(d)

5(c) Personalised wooden boxes are often used for company presentations.

- (i) Describe **three** stages in fabricating a presentation box, similar to that shown, using hand crafting techniques.
- (ii) Outline a technique to incorporate the company crest on the presentation box.



OR

5(d) PET packaging is suitable for displaying fresh salads, wraps, seafood, desserts, meats, and poultry. Its high clarity enhances the presentation of the food product.

- (i) State **two** other reasons for using PET as a food packaging material.
- (ii) Describe, with annotated sketches, a method of forming the strawberry package shown from a sheet of PET.



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Acknowledgements

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Leaving Certificate – Higher Level

Technology Section B and Section C

Monday 24 June

Afternoon 2:00 - 4:30