2024.M104A

2024L065A1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2024

Technology

Section A and Answerbook

Higher Level

Monday 24 June Afternoon 2:00 - 4:30

160 marks

Examination Number

Date of Birth / /

For example, 3rd February 2005 is entered as 03 02 05

Centre Stamp

Instructions

Write your Examination Number and your Date 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.

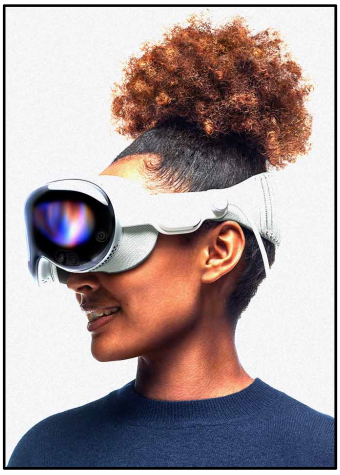
Section B 48 marks
Core – Long-answer questions.
Answer the **two** core questions presented.
Each question in Section B carries 24 marks.

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

Section A.

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

1. Apple Vision Pro is an augmented reality and virtual reality headset which has recently been launched.



Distinguish between augmented reality (AR) and virtual reality (VR).

2. Garden decking panels are increasingly being manufactured from composite materials.

Outline **two** advantages of using composite materials when manufacturing garden decking.

1.
2.

3. A 4K UHD interactive touch screen with integrated proximity sensor is shown.

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

(ii) State the function of the proximity sensor integrated into this screen.

4. The guitar amplifier shown may typically contain a Darlington pair.

(i) Name the main electronic component used in a Darlington pair.

(ii) Outline how a Darlington pair works.

5. **(i)** Use the resistor colour code table to calculate the value of the resistor shown.

Resistor bands:
Brown
Black
Red
Gold

Value:

Tolerance code		
	Brown	1%
	Red	2%
	Gold	5%
	Silver	10%

Colour code		
	Black	0
	Brown	1
	Red	2
	Orange	3
	Yellow	4
	Green	5
	Blue	6
	Violet	7
	Grey	8
	White	9

(ii) Accounting for tolerance, state the maximum and minimum possible values for this resistor.

Maximum value: Minimum value:

6. Network diagrams use nodes similar to that shown.

(i) Explain the abbreviations.

EST:

LFT:

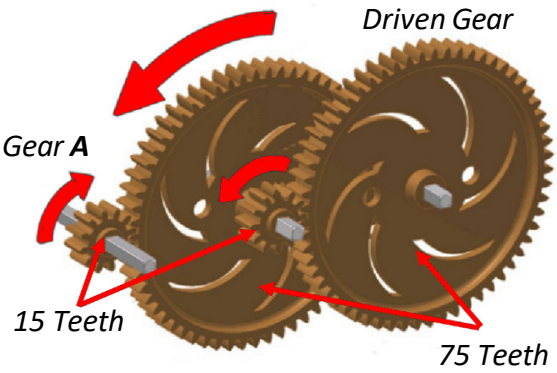
EST	**EFT**
Task:	
LST	**LFT**

(ii) Explain how the critical path of a network diagram is established.

7. **(i)** Name the type of gear train shown in the image.

(ii) Calculate the angular velocity of the driving gear **A**, if the output speed at the driven gear is 17 RPM.

Calculation:



8. An exploded view of a garden lantern is shown. Sketch a pictorial view of the assembled lantern.

9. The voltage drop at 20 mA is a common specification for light emitting diodes (LEDs). The voltage drop for a batch of coloured LEDs is shown below.

Light Emitting Diode	 Red LED	 Orange LED	 Yellow LED	 Green LED
Voltage drop at 20 mA	1.8 V	2.0 V	2.3 V	3.0 V

(i) Using the given data, calculate the value of the protective resistor required for one green LED in a 12 V lighting project.

Calculation:

(ii) Describe the effect of replacing the green LED with **two** red LEDs placed in series for the same lighting project.

10. The GPS luggage tag shown uses *satellite navigation systems* and *cellular data connectivity* to track luggage.
The tag can also be scanned using a *QR code* on the back of the device.

Explain **each** of the terms.

Satellite Navigation Systems:
Cellular data connectivity:
QR Code:

11. **(i)** Calculate the mechanical advantage of a forklift if it lifts a mass of 1800 kg with an effort force of 200 N. Assume g = 9.81 m/s^2

Calculation:

(ii) Explain the advantage of a low *centre of gravity* on the operation of the forklift.

12. Using the headings in the table below, describe the carbon footprint associated with producing small batches of car parts, such as the bracket shown, using 3D printing rather than traditional manufacturing processes.

alternator bracket for a vintage car

Energy Consumption:
Waste generation:
Materials used:

13. eBörd is a smart table with wireless charging capabilities built into its glass surface. It generates energy through the capture of indoor and outdoor light.

(i) State **one** energy conversion that takes place in the eBörd table.

(ii) Outline **two** reasons for using tubular metals in the design of the table shown.

1:
2:

14. Epoxy adhesives and PVA glue are commonly used when assembling materials.

(i) Suggest an appropriate application for epoxy resin **and** for PVA glue.

Epoxy resin:
PVA glue:

(ii) State **two** safety hazards to be aware of when using adhesives.

1.
2.

15. Make well-proportioned freehand sketches of **two** principal orthographic views of the fireside stool shown in the image below, which was designed by Irish furniture maker Tricia Harris.

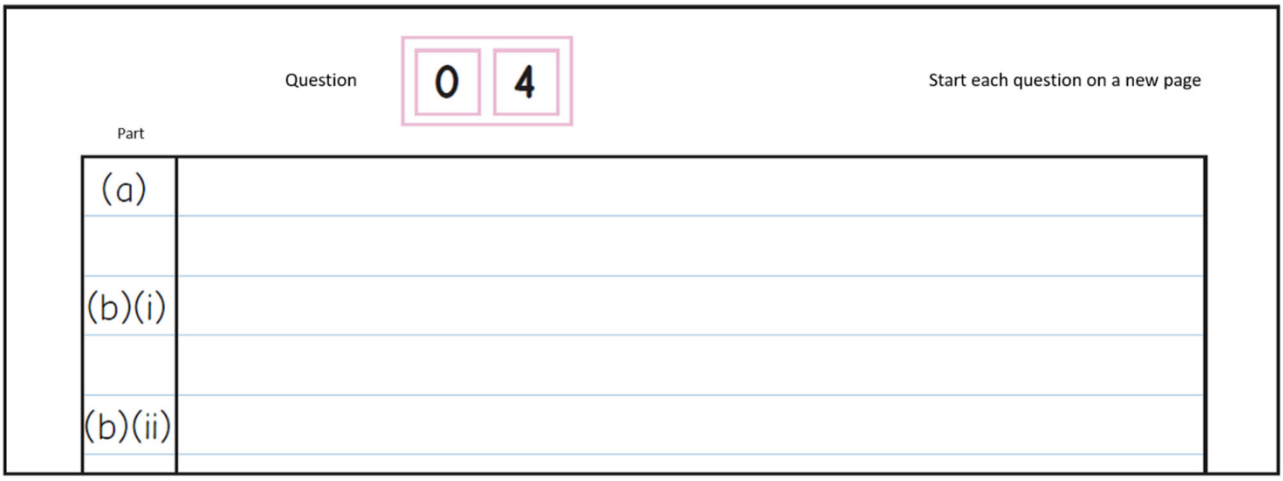
Answerbook for Sections B and C

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

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Leaving Certificate – Higher Level

Technology Section A and Answerbook

Monday 24 June

Afternoon 2:00 - 4:30

2024.M104BC

2024L065A2EL

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**.

Do not hand this up.

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

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:

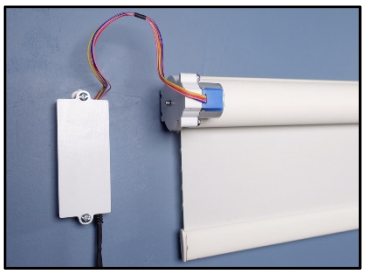
- Controller hub
- Smart lighting and thermostats
- Sensors and cameras.

(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.

Leaos e-bike with pressed frame and integrated solar panels

(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.

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

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

Single part carbon fibre handlebars

(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.

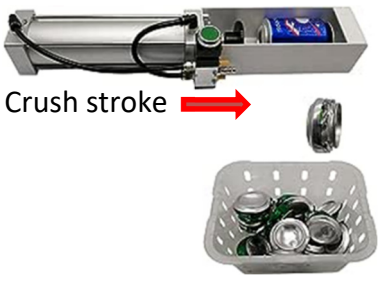
(ii) Outline the operation of a closed-loop control system.

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.



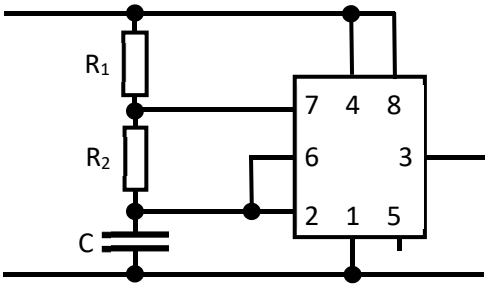
Option 2 - Electronics and Control - *Answer 2(a) **and** 2(b)*

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

(i) Outline the operation of the wireless charger shown.

(ii) Suggest **two** benefits of wireless charging of devices.

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



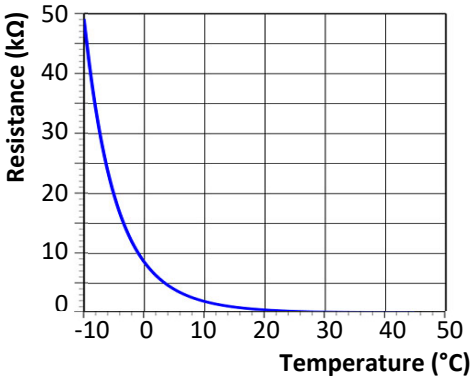
(i) Redraw the circuit diagram to include an appropriate output.

(ii) Calculate the frequency of the output if $R_1 = 10\ k\Omega$, $R_2 = 60\ k\Omega$ and $C = 10\ \mu F$.
Note: $f = 1.44 / (R_1 + 2R_2) \times C$

(iii) 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.

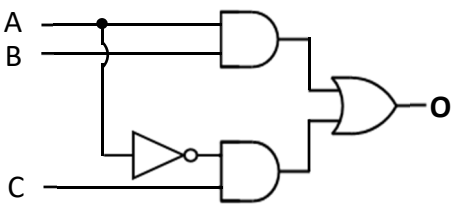


(i) State the approximate resistance of this thermistor at 0°C.

(ii) Explain why this thermistor has an effective range between -10°C and 20°C.

OR

2(d) **(i)** Draw a truth table to represent the operation of the logic gate system shown with **O** as the output.



(ii) 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**.

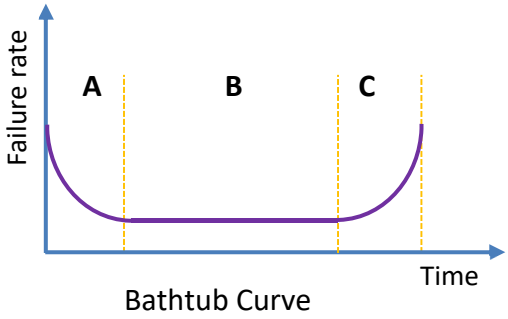
(iii) Determine the BEQ (break-even quantity) and recommend the most suitable assembly method for the product.

Please turn over ⟹

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

4(c) **(i)** Outline, with examples, the difference between quantitative accelerated testing and qualitative accelerated testing.

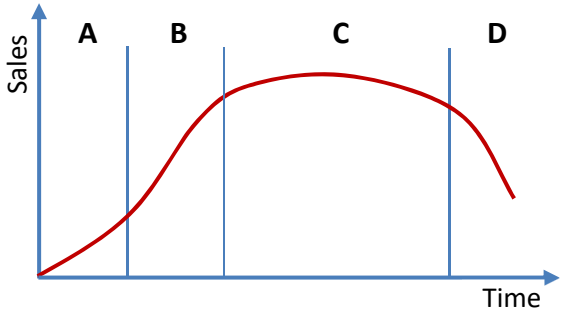
(ii) Explain **each** of the main stages of the 'bathtub' curve making reference to product reliability at each stage.



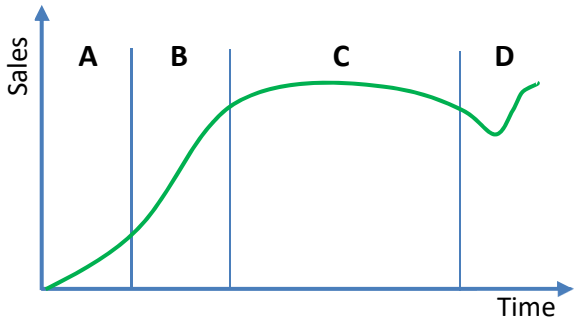
Bathtub Curve

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

Images

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Leaving Certificate – Higher Level

Technology Section B and Section C

Monday 24 June

Afternoon 2:00 - 4:30