



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2026

Technology

Section B and Section C

Higher Level

Monday 22 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)

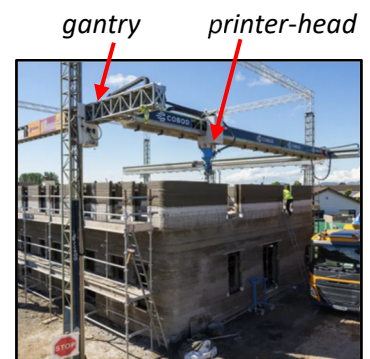
2(a) Ireland recently completed its first 3D printed social housing project in Co. Louth, consisting of two-storey terraced houses. These houses were constructed using COBOD's 3D construction printer.

- (i) State **two** advantages of using 3D printing technology for construction compared to traditional methods.
- (ii) Discuss **two** potential challenges of adopting 3D printing for the widespread construction of houses in Ireland.



2(b) The 3D construction printer uses a gantry frame structure that is specially designed for on-site concrete printing of large 3D objects.

- (i) Describe, using annotated sketches, a mechanical means of raising and lowering the printer-head platform.
- (ii) Outline **one** benefit of using a gantry frame structure in the construction of houses.
- (iii) Explain, using annotated sketches, what is meant by the term *triangulation* in a frame structure.



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

2(c) This project has been awarded the 'Standards Innovation Award' by the National Standards Authority of Ireland (NSAI).

- (i) Suggest **two** industries that might use standards developed by the NSAI.
- (ii) Using 3D printed houses as an example, distinguish between *perceived quality* and *performance* as dimensions of quality.

OR

2(d) The 3D construction printer operates in the same manner as other 3D printers, where the concrete material is dispensed in layers.

- (i) Describe, using annotated sketches, 3D printing as an additive manufacturing process.
- (ii) Explain how 3D printing can have a positive impact on the environment.



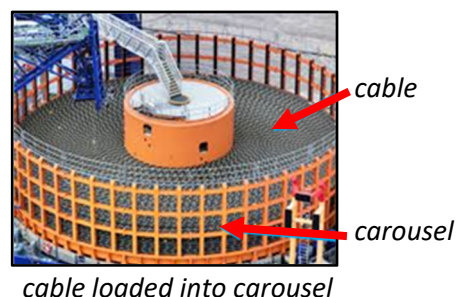
Question 3 - Answer 3(a) and 3(b)

3(a) The Celtic Interconnector is a 700 MW high voltage direct current (HVDC) electricity cable being constructed between Ireland and France.

- (i) Outline **two** advantages of the Celtic Interconnector for Ireland and France.
- (ii) Explain the importance of conductive materials and insulating materials in the HVDC cable.



3(b) A specialist marine vessel, Calypso, is used to lay the HVDC cable required to link the coast of East Cork, and Brittany in northern France. The cable is loaded into the ship carousel and then unwound when laying the cable.



- (i) Describe, using annotated sketches, an electro-mechanical means of driving the rotating carousel slowly to allow the cable to be laid on the seabed.
- (ii) Calculate how many houses (average annual usage of 3,500 kWh per house) could be served by the 700 MW of available power.
- (iii) State **two** reasons for the loss of some power over long-distance transmission cables.

Answer 3(c) or 3(d)

- 3(c)**
- (i) Differentiate, with applications, between AC and DC.
 - (ii) Outline the energy conversion that takes place in tidal energy generation.

OR

3(d) Describe the environmental impact of the large-scale transportation of goods by air (planes), land (trucks), and sea (ships) in terms of *carbon emissions* and *pollution*.



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 Tally robot is an autonomous retail robot that uses *computer vision* and RFID technology to audit shelves in real-time.

- (i) Suggest **three** benefits of using robots in the retail industry.
- (ii) Explain the term computer vision.

1(b) The Tally robot navigates aisles, audits products, and communicates data in real-time to the store management systems.

The robot operates in the following sequence:

- Power on
 - Navigate to a shelf
 - Turn on the camera
 - Check if the shelf is fully stocked
 - If the shelf is low in stock, send a system alert
 - Move to the next shelf
 - Repeat the process.
- (i) Draw a flowchart for this operating sequence of the robot.
 - (ii) Describe **two** sensors integrated into the robot to allow safe navigation in a busy shop.
 - (iii) Discuss how customer privacy can be safeguarded when programming robots.



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

1(c) Mil-tek Ireland supplies pneumatic cardboard compactors suitable for business and retail outlets.

- (i) Outline **two** reasons for the use of pneumatic control in compactor systems.
- (ii) Draw a pneumatic circuit diagram to control the movement of the piston used to compact the cardboard.



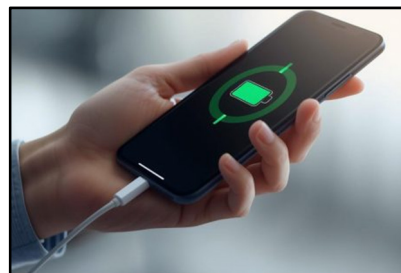
OR

- 1(d)**
- (i) Explain, with applications, the use of collaborative robots (cobots) in industry.
 - (ii) Outline the importance of the *working envelope* of a cobot on employee safety.

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

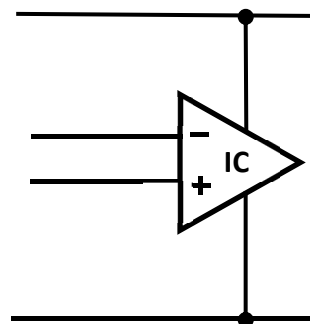
2(a) A mobile phone unlocks when the fingerprint sensor detects a matching fingerprint, or when the correct PIN code is entered. The phone will not unlock if the battery is critically low.

- (i) Draw a logic circuit that represents the unlocking of the phone.
- (ii) Compile a truth table for this logic circuit.



2(b) Operational amplifiers (op-amps) are used for the efficient operation of modern mobile devices.

- (i) Describe, with applications, the use of op-amps in modern mobile devices.
- (ii) Redraw and complete the op-amp circuit diagram shown for use as a voltage comparator.
- (iii) The battery has a capacity of 3000 mAh, and it discharges at an average hourly rate of 150 mA.
Calculate the time to fully discharge the battery.



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

2(c) Explain the purpose of **each** of the following circuit protection components:

- Circuit breaker
- PCB heat-sink
- Diode.

OR

2(d) Cork company, Composite Recycling Ltd., have developed a system for recycling phone e-waste including printed circuit boards (PCBs), LCDs, and batteries.

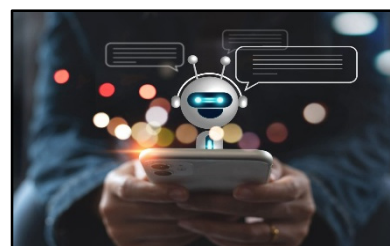
- (i) Describe, with examples, how the recycling of phone e-waste is complex and hazardous.
- (ii) Discuss how electronic components of a phone could be refurbished or reused.



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

3(a) Chatbots make use of set conversation paths, natural language processing, and machine learning to answer questions in real time and assist customers.

- (i) State **two** benefits of using chatbots.
- (ii) Outline the use of AI and machine learning in chatbots.



3(b) A rule-based chatbot consists of a user interface, a rules engine, and a Natural Language Processing (NLP) engine to process user input.

- (i) Using a 'customer service' chatbot to answer commonly asked questions as an example, describe a rule-based chatbot making reference to user interface, rules engine, and NLP.
- (ii) Distinguish between the following cyberattacks:
 - Distributed denial-of-service (DDOS)
 - Click fraud
 - Web/content scraping.
- (iii) Explain **two** limitations of rule-based chatbots.

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

3(c) A partial specification for the Nintendo Switch 2 is outlined below:

- Display: 7.9-inch LCD (1920 × 1080 resolution)
- Variable Refresh Rate up to 120 Hz
- Internal Storage: 256 GB
- Battery: 5220 mAh lithium-ion (up to 6.5 hours of battery life)



- (i) Explain any **three** of the items listed.
- (ii) Outline **one** method of increasing the data storage to 2 TB.

OR

3(d) National Broadband Ireland (NBI) is bringing high-speed fibre broadband to homes, farms, and businesses across Ireland.

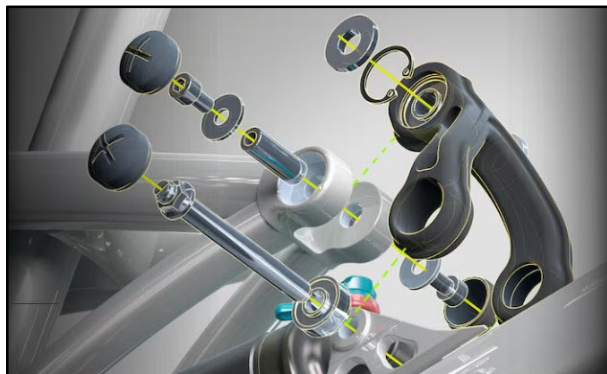


- (i) State **two** advantages of using fibre optics in the roll-out of a broadband network.
- (ii) Outline how fibre optic technology operates in a broadband network.

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

4(a) Design for Manufacture (DfM) and Design for Assembly (DfA) can be combined to offer a comprehensive strategy that enhances manufacturing and makes assembly more efficient.

- (i) Outline **two** benefits of incorporating Design for Manufacture and Assembly (DfMA) in product design.
- (ii) In **each** case, describe a factor to be considered at the design stage to support the following aspects of DfMA:
- Total number of parts
 - Multifunctional parts
 - Automation.



4(b) The table shows the number of paint defects observed on car doors produced in a factory over 12 consecutive days.

Day	1	2	3	4	5	6	7	8	9	10	11	12
Defects	2	3	4	5	3	2	6	4	3	7	5	4

- (i) Using the data above and assuming $\sigma = 1.1$, calculate the following:
- the mean of the process
 - the UCL
 - the LCL.
- (ii) Draw a suitable control chart for the above data.
- (iii) Determine the control state of this process based on the control chart.

Please turn over ➡

Option 4 - Manufacturing Systems –continued

Answer 4(c) or 4(d)

4(c) In the test and inspection stage of the production of a new model e-bike (unit), the following data has been established per shift:

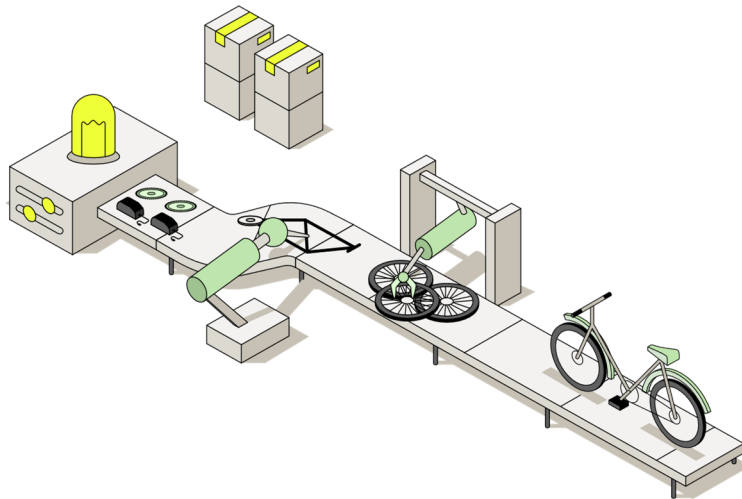
- Production output: 200 units
- Defective units detected: 10 units
- Repairable success rate of defective units: 80%.



- Determine the number of rejected units (non-repairable units).
- Calculate the process yield rate (%).
Note: Process yield rate (%) = $\text{good units} / \text{total units} \times 100$
- Outline **two** quality attributes that could be associated with the e-bike.

OR

4(d) The e-bike manufacturing company is planning to redesign its production facility to expand production, improve efficiency, and reduce waste.



Describe, with annotated sketches, **each** of these types of production plant layout:

- Product layout
- Process layout
- Fixed position layout.

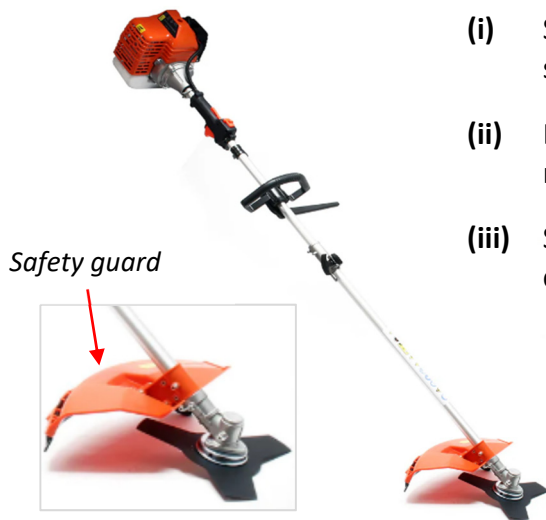
Option 5 – Materials Technology - Answer 5(a) and 5(b)

5(a) The decorative wood-fired outdoor pizza oven shown, is made from cast iron.

- (i) Outline **two** material properties that are important for producing this pizza oven.
- (ii) Describe how the outside surface can be maintained for a long life.



5(b) The multi-function gardening tool shown is widely used in landscaping.



- (i) Suggest a suitable plastic for the manufacture of the safety guard shown. Justify your selection.
- (ii) Describe, with annotated sketches, a process to manufacture the safety guard.
- (iii) Suggest **two** ways the multi-function gardening tool conforms to quality standards.

Answer 5(c) or 5(d)

5(c) The multi-function gardening tool is an example of *modular design*.

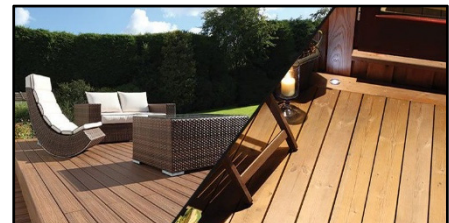
- (i) Describe, using the multi-function gardening tool shown as an example, **three** advantages of using modular design.
- (ii) Assess the environmental impact of using modular design equipment.



OR

5(d) Compare the use of composite materials with the use of treated softwood timber for the fabrication of garden furniture or decking in terms of:

- Fabrication techniques
- Maintenance
- Sustainability.



Do not write on this page

Acknowledgements

Image 1 page 2: <https://www.roadstone.ie/news/3d-construction>

Image 2 page 2: <https://lgiu.org/blog-article/louth-county-council-delivers-irelands-first-3d-printed-houses>

Image 3 page 2: <https://mylittlehome.ie/irelands-first-3d-printed-homes-dundalk/>

Image 1 page 3: <https://www.rte-france.com/en/projects/celtic-interconnector-interconnection-between-france-ireland>

Image 2/3 page 3: <https://www.bairdmaritime.com>

Image 4 page 3: <https://stock.adobe.com/ie/images/green-transport>

Image 1 page 4: <https://www.tiktok.com/discover/supervalu-tally-robot>

Image 2 page 4: <https://mil-tek.com/product/a102-cardboard-plastic-baler>

Image 1 page 5: <https://blog.comodo.com/mobile-security/>

Image 2 page 5: <https://www.hindusthanrecycling.com/>

Image 1 page 6: <https://frostbrowntodd.com/a-i-chatbots-hallucinations-and-legal-risks>

Image 2 page 6: <https://www.techbook.de/home-entertainment/gaming-konsole/n/nintendo-switch-2>

Image 3 page 6: <https://nbi.ie/>

Image 1 page 7: <https://www.autodesk.com/blogs/design-and-manufacturing/>

Image 1 page 8: <https://www.decathlon.ie/>

Image 2 page 8: <https://katanamrp.com/blog/production-layout-guide>

Image 1 page 9: <https://www.amazon.co.uk/>

Image 2 page 9: <https://gilligansales.com/products/multi-function-garden-tool>

Image 3 page 9: <https://www.arbordeck.co.uk/201607/timber-and-composite-decking->

Do not hand this up

Copyright notice

This examination paper may contain text or images for which the State Examinations Commission is not the copyright owner, and which may have been adapted, for the purpose of assessment, without the authors' prior consent. This examination paper has been prepared in accordance with *Section 53(5) of the Copyright and Related Rights Act, 2000*. Any subsequent use for a purpose other than the intended purpose is not authorised. The Commission does not accept liability for any infringement of third-party rights arising from unauthorised distribution or use of this examination paper.

Leaving Certificate – Higher Level

Technology Section B and Section C

Monday 22 June

Afternoon 2:00 - 4:30