Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2022

Marking Scheme

Technology

Higher Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

The table below contains information on annotations used for marking the examination paper.

Annotation	Use	Marks (if applicable)
	Valid information	1
	Valid information	2
	Valid information	3
	Valid information	4
	Valid information	5
	Valid information	6
	Valid information	8
	Relevant information	N/A
	Incorrect answer	0
	Page seen by examiner/ information not valid	N/A

Section A - Core 72 marks

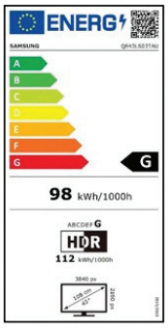
1. NASA are constantly striving to build efficiency into all phases in the design of aircraft, including development, manufacture, and operation sequences.

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

Two significant challenges identified **– generating enough lifting power for aircraft, materials selection for aircraft (strength and weight), weight of engines as well as renewable power (batteries or solar panels), aerodynamic design with reduced power, cost, etc.**

(3 + 3 marks)

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.

Any two of the following **– Poor rating on energy, QR code for model information, annual energy consumption, energy consumption in HDR mode, size, and resolution.**

(3 + 3 marks)

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

Environmental: **The responsible use and protection of the natural environment through conservation and sustainable practices, implementing energy and water efficiencies, reducing the hazardous and other waste materials, etc.**
Economic: **efficiency of water usage, quality of water, ensuring continuity of supply, etc.**
Social: **be mindful of continuous supply of resources such as water e.g., Community programmes for gathering, filtering and supply of water, eliminating waste, etc.**

(2 + 2 + 2 marks)

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.*

A vehicle that combines a conventional petrol/diesel engine propulsion system with an electric propulsion system.

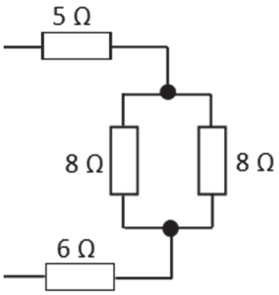
(ii) Outline **two** advantages of using hybrid buses over diesel-powered buses.

Two advantages identified - **significantly lower emissions (up to 75%), increased efficiency, decreased maintenance costs, reduced noise, etc.**

(2 + 4 marks)

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

Resistor tolerance is the deviation from the nominal value. It is expressed as a ±%, a gold band has a tolerance of ±5%, a 100Ω resistor can have a value from 95Ω to 105Ω.



(ii) Calculate the total resistance in the circuit shown.

Calculation: **1/R = (1/8 +1/8). R = 4Ω, or Product/Sum**

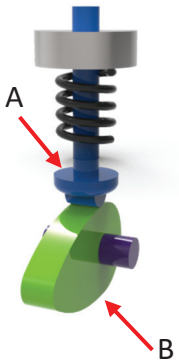
R_{Total} = 5 + 4 + 6 = 15Ω

(2 + 4 marks)

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

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

A = Follower
B = Cam



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

As the cam (B) rotates, the profile of the cam causes the follower (A) to rise and fall in its guide plate, the spring ensures that the follower is in contact with the cam ensuring constant movement.

(2 + 4 marks)

7. The image shows a bridge under construction.

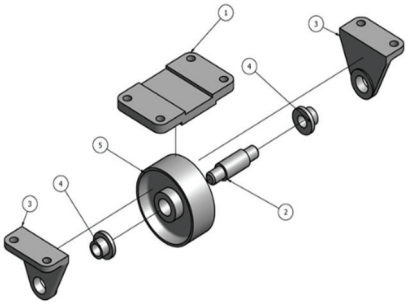
Compile a Gantt chart for the construction of a **typical** bridge.

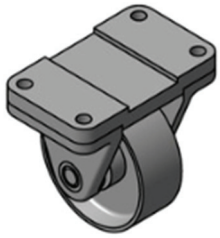
Suggested chart

Task/Month	1	2	3	4	5	6
Foundations						
Pillars						
Pre-cast Beam						
Install Beam						
Install Railings						
Safety Inspections						

(6 marks)

8. An exploded view of a castor wheel is shown. Sketch a pictorial view of the assembled castor wheel.





assembled castor wheel

(6 marks)

9. **(i)** Two computer devices used to store data are shown.
Explain the following terms:

SSD: **Solid state drive**
HDD: **Hard disk drive**

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

Price: **The newer technology of SSD is more expensive than HDD, but prices are dropping.**

Speed: **SSD will deliver 200-500 MB/s while HDD will typically have a slower speed of 80-160 MB/s.**

Storage: **HDDs can typically have greater storage capacity than SSDs.**

(2 + 4 marks)

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. Warning signs present.	Y Y
Damaged power lead	Y	**Electrocution. Injury/burn. Death.**	**H**	**Correct Amp rating fuse fitted and surge protection in place. Use soldering stand.**	
Fumes	Y	**Inhalation of toxic fumes.**	**H**	**Ventilated area. Fume extraction.**	

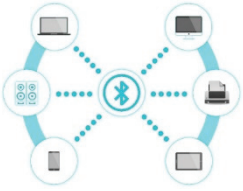
(6 marks)

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

Data transfer: **Bluetooth can transfer relatively small files between devices that have connectivity to encode, decode and transmit data via antenna.**

Wire-free control: **Bluetooth is a short-range wireless technology that is used for exchanging data between fixed and mobile devices over short distances using UHF radio waves.**

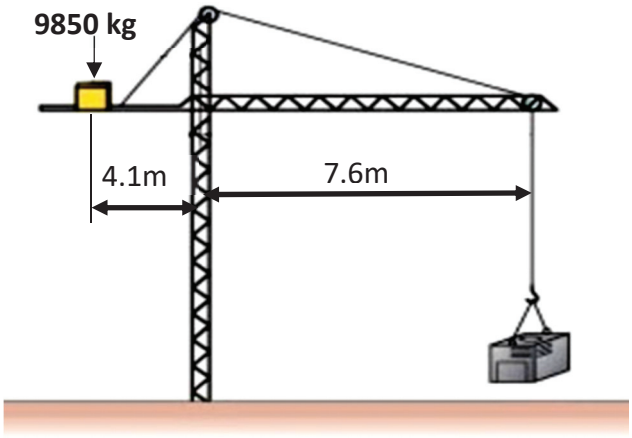
Tethering: **Can be used to share mobile device internet connection/hotspot, etc.**



(2 + 2 + 2 marks)

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:

Load × 7.6 = 9850 × 4.1
Load × 7.6 = 40,385

Load = 40,385/7.6
Load = 5313.82 kg
5313.82 kg x 10 = 53138.2 Newtons (N)
Or
5313.82 kg x 9.81 = 52128.5 Newtons (N)

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

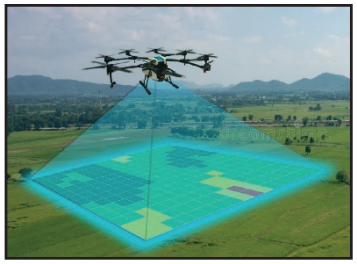
This typically involves the use of triangular shapes to give stability to structures.

(4 + 2 marks)

13. **(i)** In recent years, data capture drones have become very popular.
Name **one** application where drones could be used for data capture.

Drone Technology can be used for navigation and location-sensing during mapping, surveillance, search and rescue, disaster response, asset protection, wildlife monitoring, firefighting, communications relay, healthcare, and agriculture.

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



Positive aspects: **large volumes of data can be captured, speed of data capture, data capture can be edited while searching, etc**

Negative aspects: **Safety concerns for personal security, privacy issues, noise pollution etc.**

(2 + 2 + 2 marks)

14. **(i)** Planet Sustie, is an Irish company that supplies 100% compostable, sustainable, and *biodegradable* partyware and tableware.

Explain the term biodegradable.

Biodegradable products have the capability of being broken down and decaying into innocuous products by the action of living things (such as micro-organisms)

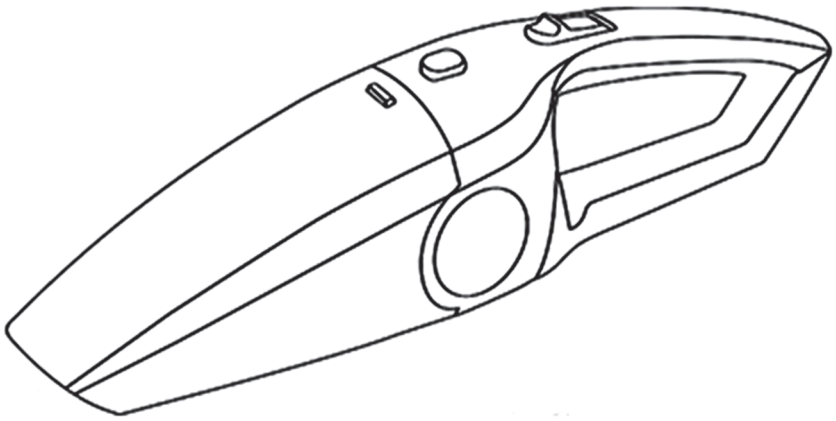
(ii) Outline **one** advantage and **one** disadvantage of using biodegradable plates and cups.

Advantages: **The manufacture of biodegradable products often takes less energy than traditional materials, meaning that it uses fewer fossil fuels and produces fewer greenhouse gas emissions that harm the planet. It also releases fewer harmful substances when breaking down. Products can be used as compost which reduces landfill, etc.**

Disadvantages: **Biodegradable plates and cups still create additional products rather than using products repeatedly, there is an incentive to manufacture more products and still must consider energy used to manufacture and transport, littering, processing, and composting is required after use, flimsy, increased safety risk, etc.**

(2 + 2 + 2 marks)

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



Two distinct graphic techniques are required.

(3 + 3 marks)

Section B - Core *Answer Question 2 **OR** Question 3* **24 marks**

Question 2 *(a) – 8 marks, (b) – 10 marks, (c) OR (d) – 6 marks*

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

2(a) (i) Describe **two** other ways in which technology can help prevent the spread of infectious diseases.
Surface cleaning and sterilisation, fogging machines, use of data analysis and communication systems, manufacture of masks/CO_2 monitors, air filtration systems etc.

(ii) State **two** other applications where UV light is used in everyday life.
Tanning lights, 'black lights' to observe fluorescence, reptile tanks, photography, Indoor growing of plants etc.

(8 marks, 4 + 4)

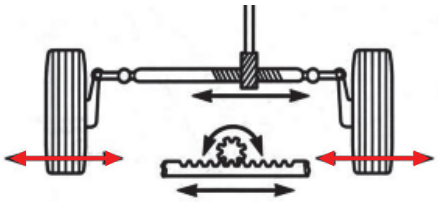
2(b) (i) Outline **two** reasons for the use of intelligent safety features in this robot.
Intelligent safety features are required to detect and manoeuvre around obstacles, to ensure that the robot can move freely and not get blocked or damage objects in its path.

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

Proximity/LIDAR/Laser/LDR etc.
Detect distance from objects/light intensity/darkness/brightness etc.

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

A range of solutions are possible including description of rack and pinion steering, castor driven system, independent drive, Ackerman steering using linkages, independent drive to each wheel, servo motor to steer single wheel in front etc.
Suggested solution:



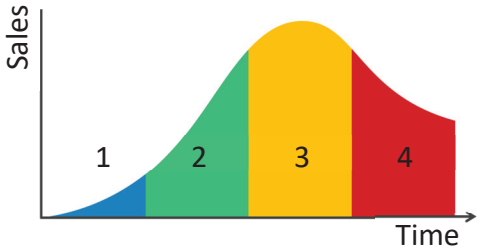
Motor-driven pinion will drive the rack and linkage to move the wheel linkage and turn wheels.

Any valid alternative solution accepted.

(10 marks, 4 + 2 + 4)

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

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



1. **Introduction:** product is launched to the market with low sales.
2. **Growth:** demand increases with steep growth in sales.
3. **Maturity:** sales are strong as product has established markets.
4. **Decline:** sales reduce as competition increases.

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

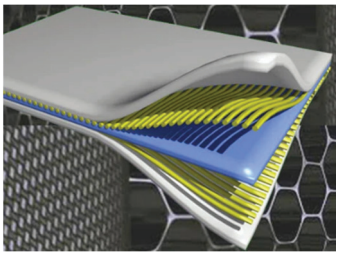
Innovation in reaction to crisis, additional features added, reduce cost as product shows decline in market share, online/tv/radio advertising etc.

(6 marks, 4 + 2)

OR

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

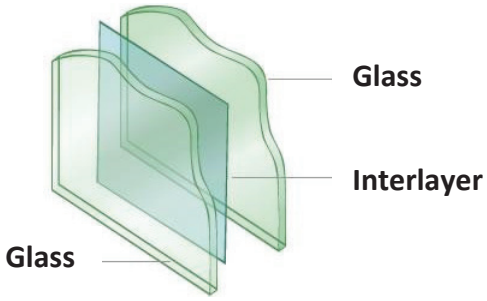
The brittleness of the plastic bonding material is compensated for with the use of strong fibre materials (glass fibre, carbon fibre, etc.).
This improves material strength especially when the layers of fibre are orientated in different directions. Stronger and lighter materials are produced.



Fibre layers in bonding plastic

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

Laminated glass is commonly used as a safety glass when security and injury are of concern. It comprises two pieces of glass with an interlayer commonly made from polyvinyl butyral. The glass is prevented from shattering as it remains stuck to the interlayer.



(6 marks, 3 +3)

Question 3 *(a) – 8 marks, (b) – 10 marks, (c) OR (d) – 6 marks*

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

3(a) (i) Suggest **one** advantage and **one** disadvantage of e-scooters for transport in cities.
Advantages: Less air pollution, avoid traffic congestion, saves on the expense of car ownership, no car parking fees in cities, etc.

Disadvantages: Insufficient number of charging points, greater risk of injury etc.

(ii) Outline **two** ways in which the comfort of the user has been enhanced on the e-scooter shown.
Handlebars have soft grips, the honeycomb wheels will have a shock absorption effect, easy manoeuvrability, lightweight and foldable, braking system increases safety, etc.

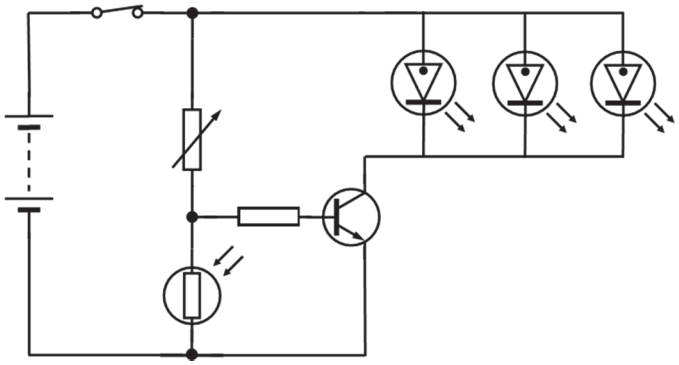
(8 marks, 4 + 4)

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

The column is hinged allowing the scooter to fold for easy storage and transporting.

Any valid alternative solution accepted.

(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.
Speed of drive, battery life, distance travelled, etc.

(10 marks, 4 + 4 + 2)

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

3(c) (i) Compare a capacitor and a battery as storage devices, in terms of energy storage, charging time, and recharging capacity.
Energy storage: In general batteries provide higher energy density for longer duration of energy release.
Charging Time: Batteries have a slower charging and discharging rate.
Charging capacity: Capacitors don't lose capacity to hold a charge, batteries ability to recharge decreases over time.

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

$R = (V_s - V_{led}) / I_{Led}$
12 – 2 = 10V
10V/20mA = 10/0.02 = 500Ω

(6 marks, 3 + 3)

OR

3(d) (i) Explain what is meant by **each** of the terms*, conformance*, and *durability*.
Conformance: **the ability of a product, service, or process to meet its design specifications.**
Durability: **the length of time a product will last or perform and under what conditions it will perform.**

(ii) Name the **four** stages of the continuous improvement model known as the Deming cycle.
Deming cycle for improvement:
PDSA (PDCA) **Plan.**
Do.
Study (or check).
Act.

(6 marks, 2 + 4)

Section C - Options *Answer **any one** of the five optional questions* **40 marks**

Option 1 - Applied Control Systems

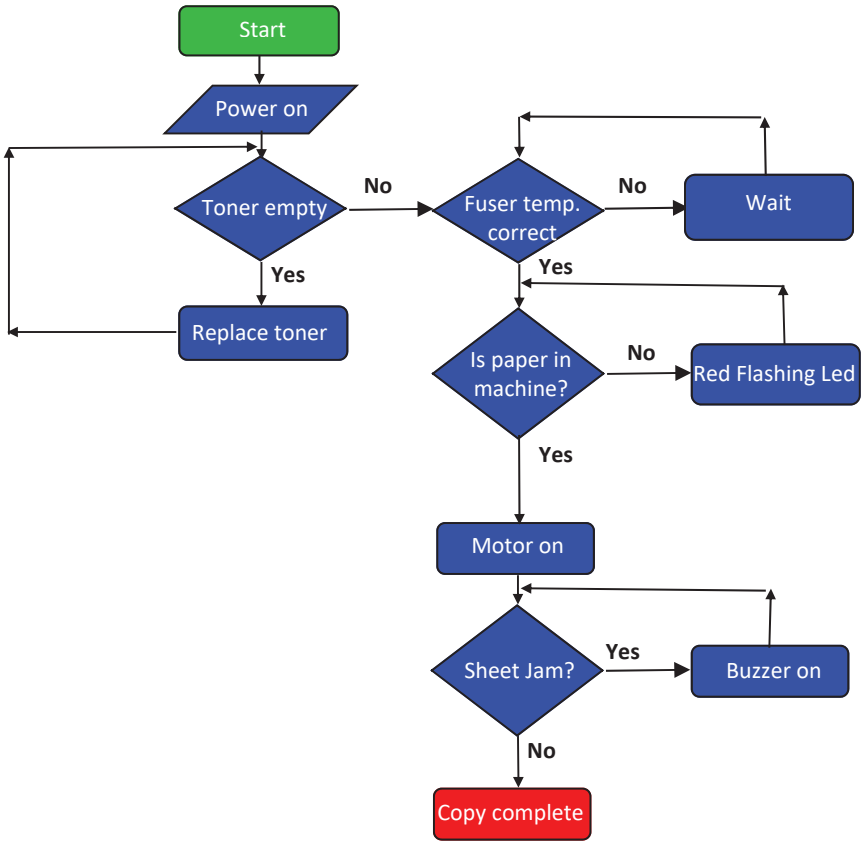
(a) – 10 marks, (b) – 16 marks, (c) OR (d) – 14 marks

*Answer 1(a) **and** 1(b)*

1(a) (i) Suggest **two** applications of recommender systems.
Applications include playlist generators for video and music services, product recommenders for online stores or content recommenders for social media platforms and open web content recommenders.

(ii) Outline **one** benefit and **one** negative consequence of recommender systems for the consumer.
Benefits: Will focus the vast amount of content to your preferences, can use past behaviour of purchases or ratings to consider content, can offer new groups or innovative ideas related to work or hobbies, etc.
Negative consequences: Recommendations may not be suitable, due to lack of data capture, increased pressure on consumer to purchase recommended items, etc
(10 marks, 6 + 4)

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



Any valid alternative solution accepted.

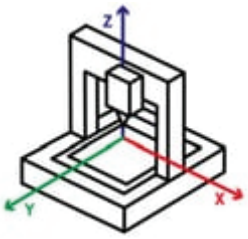
(ii) Suggest a modification to the flowchart to include a command that will count the number of sheets printed.
Use the following commands: Increment, compare and expression to record number of sheets copied.

(iii) Suggest an electronic means of determining how much toner is left in the printer cartridge.
The density of light can be sensed by an LDR-based circuit, this will detect the level of toner still in place, electronic scale to measure weight etc.

(16 marks, 10 + 4 + 2)

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

1(c) **(i)** Describe, using annotated sketches, what is meant by a cartesian co-ordinate system.
The cartesian coordinate system uses three-axis: X, Y, and Z to determine the correct positions and direction of the print head.

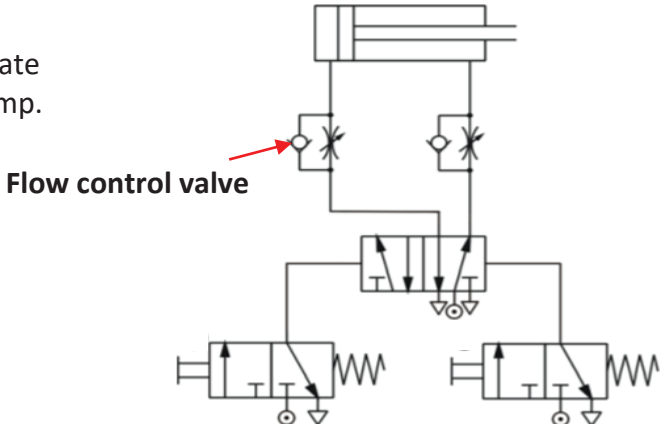


(ii) State **two** reasons for the use of stepper motors in the control of movement for the print head.
Precision control of movement due to excellent response to stopping and starting, movement is frictionless reliable, has a constant holding torque without the need for the motor to be powered, motor will not be damaged by mechanical overload, etc.

(14 marks, 8 + 6)

OR

1(d) (i) Draw a pneumatic circuit diagram to operate the double-acting cylinder used in the clamp.



(ii) Suggest a means of reducing the speed of clamping to avoid damage to the wood.
Flow control valve will control the speed of movement.

(14 marks, 10 + 4)

Option 2 – Electronics and Control

(a) – 10 marks, (b) – 16 marks, (c) OR (d) – 14 marks

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

2(a) (i) Outline the operation of the electromagnetic solenoid shown.
A solenoid works by producing an electromagnetic field around a movable core, called an armature. When compelled to move by the electromagnetic field, the motion of that armature opens and closes valves or switches and turns electrical energy into mechanical motion

(ii) Suggest **one** use for a solenoid in everyday life.
Electronic paintball guns, pinball machines, dot matrix printers, fuel injectors, door bells, electronic door openers, etc.

(10 marks, 8 + 2)

2(b) (i) Describe how the logic gate circuit shown operates. Refer to the components **A**, **B**, **C** and **D** used in the circuit.
As temperature decreases the resistance of thermistor "B" increases and when a voltage of .6V enters base of transistor it turns on, giving output 1 to OR gate "D" and buzzer sounds. The alarm can be tested by activating the push-to-make switch "C" which will also turn the output buzzer on.

(ii) Draw a truth table for the Logic Gate shown.

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	1

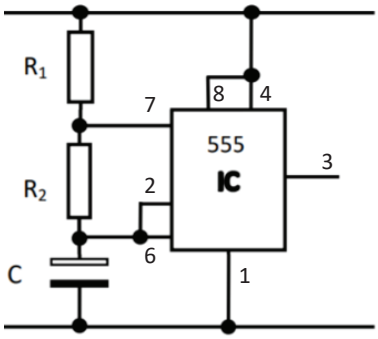
(iii) Outline how the circuit can be made more responsive to changes in temperature.
Heat sensing levels can be adjusted by changing the resistance of the variable resistor or by replacing single transistor with a Darlington Pair.

(16 marks, 8 + 4 + 4)

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

2(c) (i) Explain the function of the *trigger*, *discharge,* and *threshold* pins on the 555 timer.
Trigger: **passes on voltage to start the timing operations.**
Discharge: **connected to a capacitor in conjunction with resistor to control timing interval.**
Threshold: **Monitors voltage across capacitor and when it reaches 2/3 of supply voltage, timing cycle ends, pin 3 goes low.**

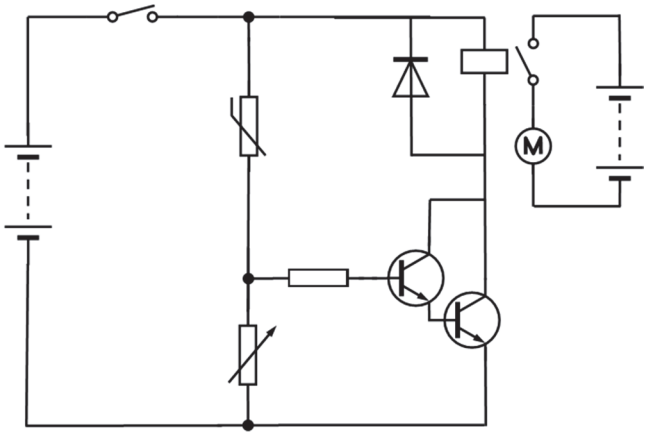
(ii) Draw the circuit configuration of the 555 timer in *astable* mode.



(14 marks, 6 + 8)

OR

2(d) (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.
A relay acts as a switching device, it can also control high voltage components from low voltage circuits.

(14 marks, 8 + 6)

Option 3 – Information and Communications Technology

(a) – 10 marks, (b) – 16 marks, (c) OR (d) – 14 marks

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

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

Commuting to work: commuting is eliminated resulting in additional time, reduced traffic congestion, less pressure on car parking, etc.
Work flexibility: much work can be scheduled at times to suit employee, easier to deal with time zone difference (early or late meetings are more convenient from home), etc.
Employee wellbeing: time away from the workplace environment can be determined by the employee, reduced stress (less commuting, interpersonal issues), environment for working can be more comfortable and personalised, etc.

(ii) Outline the features of a communications software platform used to support virtual meetings.
On-line access, clear audio and visual communication, secure access with end-to-end encryption, client interaction and presentation features, user control functions, multi-platform access by PC, tablet, phone, etc.

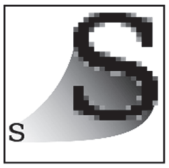
(10 marks, 6 + 4)

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

1080p/60fps fast streaming: 1080 pixel at 60 frames per second means that the screen resolution is refreshing sixty times per second creating a smooth clear picture suitable for viewing and streaming.
wide adjustable field of view: the maximum area that a camera can image.
5 × Zoom: the camera lens can zoom to five times the widest focal length; this magnifies the image

(ii) Describe how a 20GB video file can be shared online.
Use cloud storage space such as Google Drive, Dropbox, or OneDrive, create and share link from cloud storage etc.

(iii) Outline, using annotated sketches and examples, the differences between *bitmap* images and *vector* images.
Bitmap images (also called "raster") are created from rows of different colored pixels that together form an image.



Vector images (also known as "object-oriented") are constructed using mathematical formulas describing shapes, colours, and placement.

(16 marks, 6 + 4 + 6)

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

3(c) (i) Explain the term ransomware.

Ransomware is a form of malware designed to encrypt files on a device, rendering any files and the systems that rely on them unusable. Malicious actors then demand ransom in exchange for decryption.

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

Multi-factor authentication: An authentication system that requires more than one distinct authentication factor for successful authentication. A common example of multi-factor authentication is using a password together with a code sent to your smartphone to authenticate yourself.
Encrypted file sharing: Encrypted file transfer works when a file needs to be sent from one device to another, typically over an external network or Internet, which is not secure. The file is encrypted using encryption algorithms and the file encryption key is shared only with the file sender and recipient.
Password manager: A password manager is a tool that does the work of creating, remembering and filling in passwords.

(14 marks, 6 + 8)

OR

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

System software: software designed to provide a platform for other software to operate, these include operating systems, MS Windows, MacOS, Linux, etc.
Utility software: software that helps to maintain the proper and smooth functioning of a computer, it includes memory testers, network utilities, registry cleaners and anti-virus.
Application software: software designed to help people with information technology and make users more productive or assist them with personal tasks, this includes word processor, spreadsheets, photo editing, etc.

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

Wide Area Network (WAN): occupies a very large area, such as an entire country or the entire world. The Internet is the best-known example of a public WAN.

Local Area Network (LAN): a computer network at a single site, typically an individual office building. A LAN is very useful for sharing resources, such as data storage and printers.

(14 marks, 6 + 8)

Option 4 – Manufacturing Systems

(a) – 10 marks, (b) – 16 marks, (c) OR (d) – 14 marks

*Answer 4(a) **and** 4(b)*

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

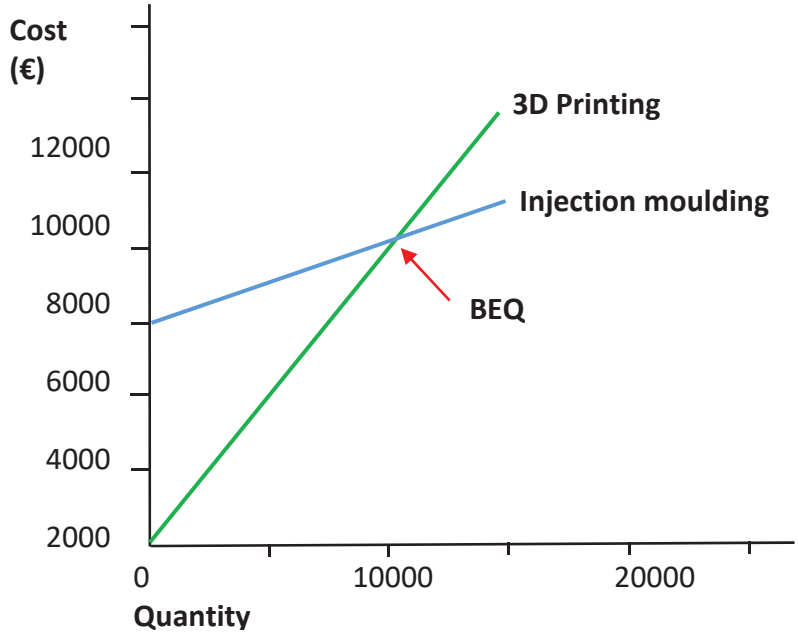
Design for fast assembly: The design process includes ease and speeds of assembly as factors in product development e.g., reduced number of parts, easy to use fasteners, use of 'snap fit', etc.
Modular design of products: An approach used to design products or applications by breaking it down into separate or independent parts. These individual parts (for example, a laptop battery) can then be used for the same functionality in different systems or products.

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

Products and assembly techniques can be tested during the design stage by computer simulation. Programmes will simulate the operation of a product with a view to speed of assembly, operational efficiency and product manufacture with editing and alterations undertaken virtually in advance of production.

(10 marks, 6 + 4)

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



(ii) Determine the BEQ (break-even quantity).
BEQ = Set-up cost/(3D cost/item – Injection cost/item)
BEQ = 6000 / 0.8 – 0.2 = 10,000 units

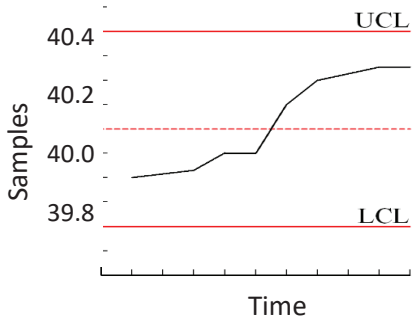
(iii) Outline **three** other significant factors to be considered in the decision on how to produce batches of the headphone stands.

Design requirements to personalise design, choice of materials, redesign new features on stand, add accessories, aspects that will increase labour costs, packaging, and logos.

(16 marks, 8 + 2 + 6)

*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.



(i) Evaluate the process presented in the control chart above and predict if the process is likely to remain in control.
The process is still in control as all points are between UCL and LCL. However, process came close to UCL but started to turn back over time, process likely to stay in control.

(ii) Briefly describe **two** quality control measures a manufacturer can undertake during a production process.
Make adjustments/calibrate process on regular basis, faults can be identified and rectified, integrate control measures to analyse production process, regular sampling, and regular maintenance of equipment etc.

OR

(14 marks, 8 + 6)

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**.
A is a decreasing failure rate, known as early failures.
B is a constant failure rate, known as random failures.
C is an increasing failure rate, known as wear-out failures.

(ii) An intervention to reduce the failure rate of the drill at stage **A**.
Comprehensive testing and identification of faults before launch on to the market.

An intervention to reduce the failure rate of the drill at stage **C**.
Ensure warranties expire before reaching this stage, identification of common failures to investigate if failure avoidance is economical, etc.

(14 marks, 6 + 8)

Option 5 – Materials Technology

(a) – 10 marks, (b) – 16 marks, (c) OR (d) – 14 marks

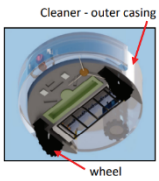
*Answer 5(a) **and** 5(b)*

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

Stainless steel/Aluminum. Strong robust metal capable of withstanding impact. Does not need a surface finish, it will not corrode. Has an attractive shiny silver finish.

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

Wheels made from rubber: production of rubber leads to air pollution, when heated for molding it also releases toxins into the air. Water pollution is also associated with synthetic rubber production, which produces Butadiene. Difficult to dispose of unwanted rubber, usually goes into landfill etc.

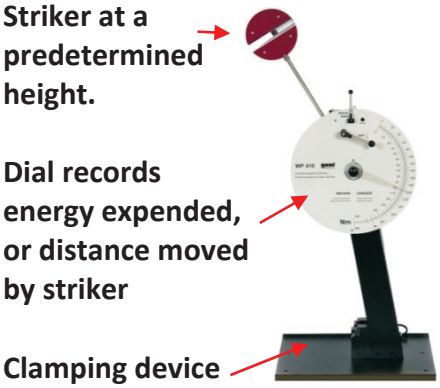


(10 marks, 4 + 6)

5(b) (i) State **two** reasons why destructive testing of materials is carried out during the design phase of devices such as vacuum cleaners.
Impact tests establish the breaking point of the material, other forms of testing will not establish this data. Design features, particularly thin plastic sections, need to be analysed to establish if further strengthening is needed. There is a demand that products do not fail by breakage so testing before sales is essential.

(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.

The impact test is carried out in a controlled environment as the samples are likely to break.
Each material is clamped in the machine and struck with a consistent load. The amount of energy expended by impact can be measured with values compared for each material.
This give an indication of impact resistance.



(iii) Describe, using annotated sketches, a means of strengthening materials during their design or production.
Materials can be corrugated, especially useful for thin materials.

Composite materials can be reinforced with fibres
Plastic components can have strengthening ribs added for robustness.

Corrugated sheet

Fibre-reinforcement

Impact of ribbed products

Other design or production techniques acceptable. *(16 marks, 6 + 6 + 4)*

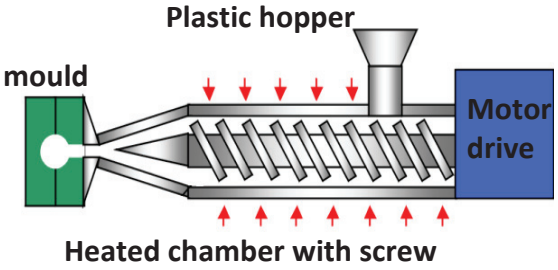
Answer 5(c) ***or*** *5(d)*

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.
Transparent Polycarbonate, polypropylene, HDPE, ABS etc which are all impact resistant.

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

Injection moulding: plastic pellets are loaded from the hopper through the heated chamber. It is pushed into the cover shaped mould by the rotating screw.

Appropriate alternative solutions acceptable.



(14 marks, 6 + 8)

OR

5(d) **(i)** Explain, with **one** example in **each** case, the uses of nylon in fibres, film, and extruded sections.
Fibre: Nylon is manufactured or cut into thin strands e.g., nylon rope, clothing, etc.
Film: Nylon is rolled into very thin sheets e.g., packaging film for food or pharmaceuticals, etc.
Extruded: machined into long sections which may be cut to the required length e.g., round bars and tubes, conveyor guides, gears, etc.

(ii) Describe **two** properties that makes nylon suitable for gear wheels.
Durable, high mechanical strength, good fatigue resistance will not degrade easily in use. Good sliding properties with additional oil or lubricating materials rarely used. Good machinability makes nylon easy to cut and drill.

(14 marks, 6 + 8)

Coimisiún na Scrúduithe Stáit
State Examinations Commission

2022. M103P
2022. M104P

Leaving Certificate Examination, 2022

Technology

Coursework Briefs

Ordinary Level and Higher Level

200 marks

The Thematic Briefs for the Leaving Certificate Examination 2022 are given overleaf.

The Coursework must be available for assessment by Friday 8 April 2022.

Leaving Certificate Technology

Ordinary Level and Higher Level 2022

Instructions to candidates:

1. The coursework submitted for assessment must consist of two components:
   - a design folio *and*
   - an artefact.

2. If **either** assessment component (written examination or coursework) is submitted at Ordinary Level, the subject is graded at Ordinary Level.

3. All coursework submitted for assessment must be clearly identified with your examination number.

4. The coursework submitted for assessment must be **your own individual work** and must be completed in school under the supervision of the class teacher.

5. Your coursework must not be removed from the school setting under **any** circumstances as doing so may result in such coursework being considered invalid.

6. The design folio should record all stages of your work and should document how the artefact meets the stated thematic brief.

7. When using research sources, including the Internet, the sources **must be acknowledged**. Research material copied directly from the Internet or from other sources and presented as your own work will not receive any marks.

8. The coursework should display knowledge and skills developed through your study of the core and chosen options.

9. All important operating features of the artefact must be clearly visible and be easily accessible without dismantling.

10. Where an electrical supply is used to operate the artefact, it should be of low voltage output. Where specialised equipment is required, it must be set up by you, have clear operating instructions and be ready to use.

11. The coursework presented for assessment must be displayed in an attractive manner. Multimedia presentations, where submitted, must be of **maximum** 3 minutes duration, must be set up by the candidate and must be ready for viewing.

The coursework must be available for assessment by Friday 8 April 2022.

Leaving Certificate 2022 - Higher Level

Thematic Brief

The term disability can refer to any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities (activity limitation) or interact with the world around them (participation restrictions). It is a complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives.
(Adapted from https://www.cdc.gov/ncbddd/disabilityandhealth/disability.html).

There are many types of disabilities, including, but not limited to, those that affect a person's:

- Vision
- Movement
- Learning
- Communicating
- Hearing
- Social relationships

In this context and with a focus on modern materials and processes, design and manufacture a working model of a device, system or technological aid that could enhance or improve the quality of life of a person with a disability.

Your solution should include an electro-mechanical element and should also be well presented.

Note: The maximum dimension of the artefact you present for assessment should not exceed 500 mm.
If multimedia presentations are used to enhance your display, a hardcopy printout and a digital file (USB flash drive) must be included in your portfolio.

Coursework at Higher Level is weighted as follows:

- Design Folio - 50% of marks
- Artefact - 50% of marks

Total - 200 marks

Design Folio - Higher Level - 100 marks			
No.	***Heading***	***Description***	***Marks***
1	Analysis of thematic brief	Evidence of research of the broader context of the theme. Specification of chosen parameters.	10
2	Overall management of the project	Analysis of available resources, time and budget constraints; proposed timeframe/Gantt chart, etc.	5
3	Environmental impact of the project	Demonstration of environmental awareness during **design and realisation**. Analysis of materials chosen for manufacture. Consideration of energy requirements, reuse/recycling etc.	10
4	Research, investigation and specifications of brief	Further research into chosen area. Analysis of existing solutions including sub-systems. A statement outlining the candidate's final brief and related specifications.	10
5	Design ideas and selection of optimum solution	Annotated **freehand** sketches **related to your design specification**, outlining three possible solutions. Optimum solution identified and justified.	15
6	Sketches and drawings for manufacture	Detailed annotated sketches and drawings including all elements/aspects of solution; circuit diagrams/flowcharts/models/prototypes/dimensions/scale/assembly details.	15
7	Production planning	Materials and component list **and** costings; scheduling, work breakdown structure; Gantt charts, critical path diagrams.	10
8	Product realisation	Sequence of manufacture including photographic record.	10
9	Testing, evaluation and critical reflection	Testing against chosen brief. Evaluation of final artefact. Comparison of planned schedules and actual schedules. Suggested modifications with justification. Critical reflection on the entire process	10
10	Presentation and ICT	Correct sequence of presentation. Quality of material presented. ICT skills in production and presentation of folio.	5

Artefact - Higher Level - 100 marks			
No.	***Heading***	***Description***	***Marks***
1	Artefact meets theme and specifications	Solution presented fulfils the thematic brief and the specifications as identified by the candidate.	10
2	Originality and creativity	Originality and creativity in design, aesthetics and ergonomics. Creative and appropriate use of materials.	15
3	Production skills	Processing of materials. Assembly of materials. Range and depth of skills.	30
4	Functionality	Artefact works well. Appropriate/limited use of commercial components/solutions.	20
5	Quality and finish	High quality manufacture. Artefact well finished. Due regard for health and safety.	15
6	Presentation	Coursework well presented. Parts well integrated and labelled where appropriate.	10

Note: ***While the general headings and marks above will largely remain the same, breakdowns may vary depending on the actual brief for any given year.***