Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2013

Technology

Higher Level

Friday, 21 June
Afternoon, 2:00 - 4:30

Section B - Core *(48 marks)*

*Answer **both** questions.*
Each question in Section B carries 24 marks.

Section C - Options *(80 marks)*

*Answer **two** of the five options presented.*
All questions in Section C carry 40 marks.

Instructions:

(a) *Answer these questions in the answerbook provided.*

(b) *Write your examination number on the answerbook.*

(c) *Draw all sketches in pencil.*

(d) *Hand up the answerbook at the end of the examination.*

Section B - Core - *Answer Question 2* ***and*** *Question 3.*

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

2(a) Time magazine listed the product 'Sugru' by Kilkenny inventor, Jane Ní Dhulchaointigh, as one of the best inventions of 2010. Sugru is a type of silicone rubber. It is malleable when removed from its airtight and moisture-proof packaging, retains its plasticity for thirty minutes, and is self-curing at room temperature after approximately 24 hours. Sugru adheres to most materials and has a shelf life of six months.

(i) Explain **each** of the terms *malleable* and *self-curing*.

(ii) Outline the importance of product shelf life.



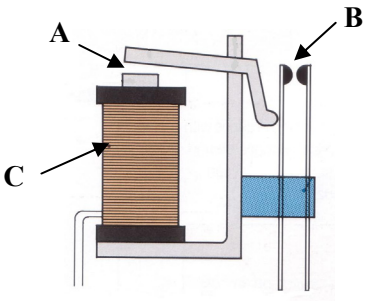

2(b) Some uses for 'Sugru' are shown in the images above. Discuss, using examples, **each** of the following aspects of the 'Sugru' product:

(i) Sustainability through repair.

(ii) Ergonomic features in design.

(iii) Internet marketing and selling.

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



2(c) A motor can be switched on and off by a relay.

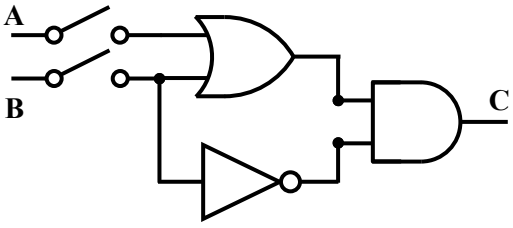
(i) Explain in detail, using annotated sketches, how a relay operates as an electronic switch for a motor circuit.
Make reference to parts **A**, **B** and **C**.

(ii) Give **two** examples where a relay is used to control a motor.

OR

2(d) (i) Distinguish clearly between electrical *conductors, insulators* and *semiconductors*.
Use examples to support your answer.

(ii) Draw the truth table for the logic circuit shown.



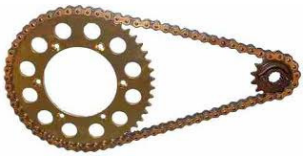
Question 3 - *Answer 3(a)* ***and*** *3(b)*

3(a) The Paralympic Games is a major international event, involving athletes with a range of disabilities including mobility restrictions, amputations, blindness and cerebral palsy.

(i) Outline some societal benefits of the Paralympic Games.

(ii) Technology underpins many aspects of the organising, staging and managing of the Paralympics. Outline **two** ways in which technology supports or enhances such an event.

3(b) Athletes without the use of their lower body use tricycles propelled by hand-pedals in the road cycling event.



drive-chain

(i) Explain why these tricycles sit low to the ground with one wheel at the front and two at the back.

(ii) Suggest suitable materials for the frame and for the wheels.

(iii) Correct drive-chain tension is essential for the efficient pedalling of the tricycle.
Describe, using annotated sketches, **one** method of maintaining tension on the drive-chain shown.

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

3(c) With reference to the design and manufacture of the hand cycle shown above:

(i) Use annotated sketches to show how the front wheel could be mounted to the frame.

(ii) Explain how a wheel bearing can be used to minimise friction.

OR

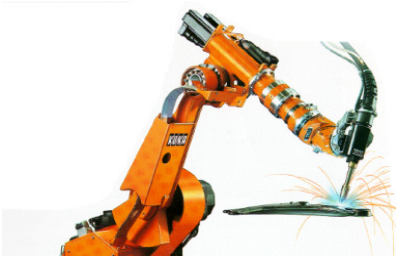
3(d) *Felix Baumgartner* was the first person to break the sound barrier without vehicular power on his descent from space during his sky jump in 2012. He wore a protective suit and a helmet made from a composite material.

(i) Identify **two** key properties required of the composite material used to make the helmet.

(ii) Name **any two** common composite materials.

Section C - Options - *Answer **any two** of the Options.*

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



1(a) (i) Outline **two** advantages of the increased use of automation in industrial welding.

(ii) Identify **two** other industrial processes that use automated control.

1(b) (i) A microcontroller contains a *programmable IC* with *input* and *output* components. Explain the function of **each** part of the microcontroller.

(ii) A school chess club requires a precise timer that can be reset by a player after each move is completed.
Players are allowed 2 minutes to complete each move.

The timer will use the following sequence:

- Start with LED and buzzer off
- Press switch 1 to begin the game
- Wait for 2 minutes (for a player to move) then check if reset has been pressed. If yes, return to start. If no, go to next line
- LED and buzzer on and off every 0.5 seconds until switch 2 is pressed
- Press switch 2 to return to start.

Complete a flowchart for the operation of the chess timer.

(iii) A tournament chess game lasts for 2 hours. Suggest a sub-routine to indicate the end of the game.

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

1(c) ASIMO is a humanoid robot created by Honda and introduced in the year 2000. ASIMO, which is an acronym for *Advanced Step in Innovative Mobility* was designed to be a personal helper.

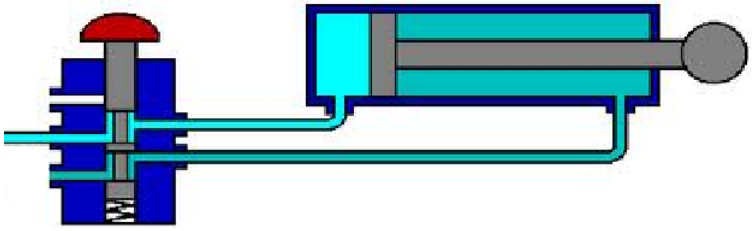
(i) Describe the main features of a humanoid robot.

(ii) Identify **two** possible applications for humanoid robots.

OR

1(d) (i) Describe, in detail, the operation of the pneumatic circuit shown.

(ii) Explain the purpose and use of a *cushioned cylinder* in such a circuit.



5/2 Valve

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

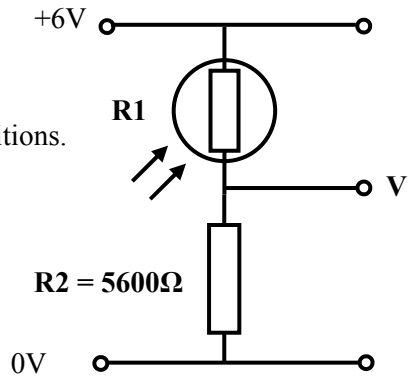
2(a) LED torches have become very popular in recent years as a replacement for filament bulb torches.

(i) State **two** advantages of using LED's rather than filament bulbs.

(ii) An LED cluster connected to a 9V supply requires 15mA (*If*) to operate efficiently.
There is a forward voltage or voltage drop (*Vf*) of 2V across the cluster.
Select a resistor from the available sizes of 330Ω, 390Ω, 470Ω, 560Ω and 680Ω to protect the cluster and justify your selection.

Note:
$$R = \frac{Voltage - Vf}{If}$$

2(b) A voltage divider circuit is shown.



(i) The resistance of component R1 ranges from 2kΩ to 20kΩ.
Calculate the voltage V for **both** low light-level and high light-level conditions.

(ii) This voltage divider circuit could be used in conjunction with a comparator to make a light-level warning device.
Draw a complete circuit that will switch on a 12V floodlight when light levels are low.

(iii) Describe how the circuit you have drawn at (ii) above operates.

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

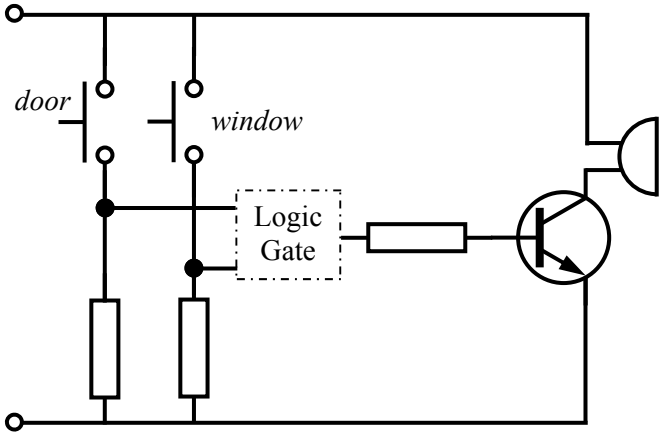
2(c) Small DC motors are simple and relatively inexpensive components which are widely used in toys and games.

(i) Describe, using annotated sketches, the principles of operation of a DC motor.

(ii) Outline the key features of a mains powered supply (220/240V) used to drive a 12V DC motor.

OR

2(d) An example of a logic gate used as part of a simple garage alarm is shown. The buzzer will sound when the switch fitted on either the door or the window is opened.



(i) Name a suitable logic gate for this circuit.

(ii) Describe how the circuit could be improved by the addition of an electronic latch.

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

3(a) (i) Cyber bullying on social networking sites is a significant issue for many teenagers.

Outline **two** ways of protecting yourself against cyber bullying.

(ii) Outline what is meant by the term *'internet trolling'*.

3(b) (i) Name **two** expansion bus components.

(ii) Suggest **two** advantages and **two** disadvantages of using computer networks.

(iii) Describe the main components, features, capabilities and limitations of a wireless network.

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

3(c) The build-up of heat is a particular design concern in the development of computer laptops.

(i) Outline **three** ways in which heat may be dissipated in laptops.

(ii) A popular screen resolution for widescreen laptops is 1280 × 800.

Explain what is meant by *'screen resolution'* and by *'1280 × 800'*.

OR

3(d) (i) A webpage can contain both text and images.

Give **three** other elements which may also be included on a webpage.

(ii) With reference to sound waves, outline the meaning of **each** of the following terms:

- Sampling rate
- Amplitude
- Sample format.

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

4(a) Since their introduction in 1996, the number of 'Smartphone' devices in use has exceeded one billion. New devices appear and quickly become obsolete. Quality, reliability and extra functionality are important and desirable features of these devices.

(i) Explain the difference between *quality* and *reliability*.

(ii) Suggest how the principles of DfE (Design for Environment) are incorporated into these devices.

4(b) The data table below gives the number of defects per day for a batch of cornflakes during its manufacture.

Day	July 11th	July 12th	July 13th	July 14th	July 15th	July 18th	July 19th
No. of defects	10	8	11	10	9	10	12

(i) For the data above and assuming σ = 1.29, calculate the following:

- The mean of the process
- The UCL
- The LCL.

(ii) Draw a suitable control chart for the above data.

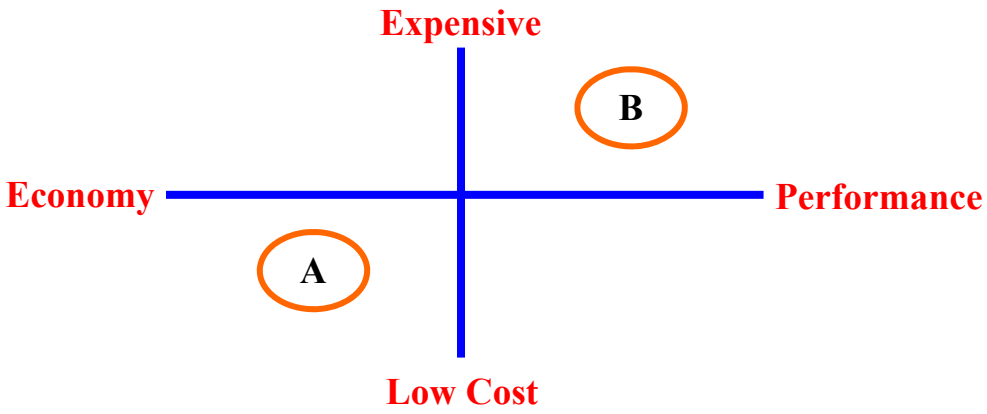
(iii) Interpret the control chart drawn at (ii) above and comment on the control state of the process.

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

4(c) *Perceptual Mapping*, *Benchmarking* and *Reverse Engineering* are often used in the generation of ideas for technological products.

(i) Describe, with examples, the terms Benchmarking and Reverse Engineering.

(ii) Discuss, with examples, the features of car brands placed at **A** and **B** of the perceptual map shown below.



OR

4(d) (i) *Facility layout* and *work flow* are important considerations to enhance efficiency and competitiveness in a manufacturing environment.

Describe **two** basic layouts that are used by manufacturing firms.

(ii) The choice of processes used to make an item depends on the characteristics of the product and the volume of the product being made. Production processes can be classified as *batch production*, *mass production* or *continuous production*.

Describe, with examples, **each** of these processes.

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

5(a) (i) Describe the key features of **each** of the following material categories:

- Thermoplastics
- Smart materials
- Manufactured boards.

Use specific examples in each case to support your answer.

(ii) Outline the main safety hazards associated with **each** of the following material processing techniques:

- Cutting MDF on a circular saw
- Joining plastic materials using adhesives
- Cutting metal on a centre lathe.

5(b) With increased independence for older citizens has come a demand for practical devices to enhance personal safety. Two innovative safety devices are shown below.

Door wedge with siren is placed at the bottom of door to limit entry.

Key fob alarm is activated by pressing button to emit a high-pitched sound.

(i) Select an impact-resistant material for the door wedge and justify your selection.

(ii) The key fob is manufactured in three plastic parts - the button, base and front cover. Describe, using annotated sketches, a method of commercially manufacturing the front cover of this device.

(iii) Explain, using notes and annotated sketches, a method of assembling the three parts of the key fob.

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

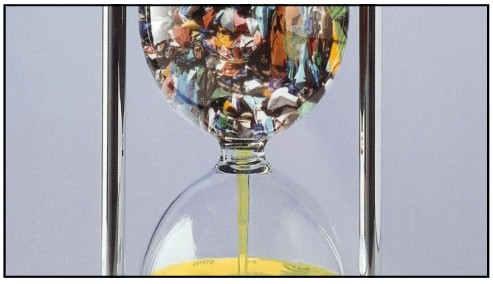
5(c) The body of the toy car shown has been *vacuum formed*.

(i) Explain, using annotated sketches, the process of vacuum forming.

(ii) Discuss the environmental impact of producing the toy car using vacuum forming techniques.

OR

5(d) In 2010, Portlaoise firm Cynar Plc. announced a landmark recycling technology agreement with SITA UK. Cynar focuses on conversion technology where a variety of end-of-life mixed waste plastics destined for landfill are converted into useable liquid fuels.



(i) State **three** advantages of the increased use of this conversion technology.

(ii) Outline **three** properties of thermosetting plastics.

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