



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2017

Technology
Higher Level

Friday, 23 June
Morning, 9:30 - 12:00

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)

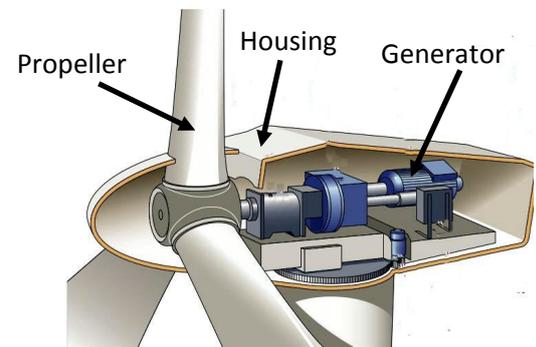
2(a) Wind energy is a growing sector in Ireland, creating jobs and benefiting communities. There are 207 wind farms in Ireland with an *installed capacity* of 2527 MW.

- State **two** advantages of electricity generated from wind power over electricity production using fossil fuels.
- Explain what is meant by an installed capacity of 2527 MW.



2(b) The propeller of a wind turbine rotates at speeds of 30-60 rpm. These speeds are increased by a ratio of 30:1 in order to produce electricity at the generator.

- State **two** energy conversions in a wind turbine system.
- Describe, using annotated sketches, a mechanism to increase the speed of the output shaft by a ratio of 30:1 in order to produce electricity at the generator.
- Suggest, using annotated sketches, a method of reducing energy losses due to friction as the propeller rotates.



Answer 2(c) or 2(d)

2(c) The foundation/base for securing a wind turbine to the ground is made from reinforced concrete. Concrete is a *composite material*.

- Explain the term composite material using concrete as an example.
- Suggest, using annotated sketches, an appropriate means of attaching the wind turbine to the reinforced concrete foundation/base.



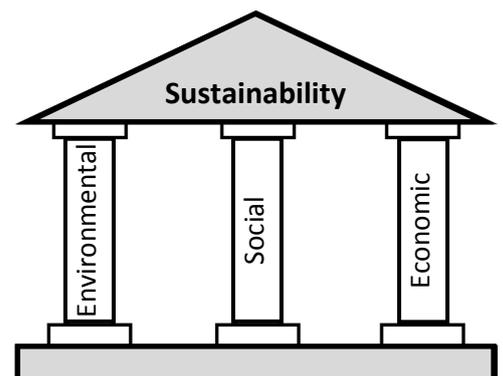
OR

Foundation/base

2(d) *Sustainability* is a key concept in controlling the amount of waste created by society.

Explain, with examples, what is meant by **each** of the three 'Pillars of Sustainability' given below:

- environmental sustainability
- social sustainability
- economic sustainability.



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

3(a) Wearable technology refers to electronic technologies or computers that are incorporated into items of clothing and accessories which can comfortably be worn on the body.

- (i) Outline **one** application of wearable technology for leisure use.
- (ii) Describe **one** electronic sensor that could be used in wearable technology.



3(b) The Irish company, STATSports©, have developed the Viper Pod monitor and software.

The Viper Pod allows the capture of unobtrusive feedback on individual player performance. The pod is an award-winning, ergonomically designed unit that is widely used by professional sports people.

- (i) Explain the term ergonomically designed.
- (ii) Describe the value of GPS (Global Positioning System) capability for the Viper Pod monitoring technology.
- (iii) A green LED illuminates to signify that the Viper Pod is activated.



Viper pod

If the LED has a $V_f = 3.2 \text{ V}$ with $I_f = 25 \text{ mA}$, calculate the value of the protective resistor required when powered by a 9 V battery.

Answer 3(c) or 3(d)

3(c) The Viper Pod is manufactured from a tough, durable thermoplastic in two colours.

- (i) Describe, using annotated sketches, how the two parts of the casing might be assembled.
- (ii) The pod weighs less than 50 g. Suggest **one** design detail of the casing to help ensure that the pod is light yet durable.



OR

3(d) It is important that the Viper Pod is reliable and of high quality.

- (i) Name **one** quality characteristic and specify **one** related quality attribute for the Viper Pod.
- (ii) The production of the Viper pod includes installing a gyroscope, accelerometer, microprocessor and circuitry as well as production of the casing. Outline a simple work breakdown structure for the production of the Viper pod.

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

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

1(a) Home automation or *smart home* is the control and automation of domestic devices and systems.

- (i) Select **two** systems in a domestic setting that can be automated. In each case justify your selection.
- (ii) *Phone Apps* are now commonly used in conjunction with home automation systems. Explain why Phone Apps are appropriate for this application.

1(b) Smart waste bins are being developed to collect used mobile phones. The phones will be recycled or reused rather than sent to landfill as e-waste.

A smart bin uses the following sequence of operation:

- when the bin is powered on, the phone is scanned for useful parts
- following assessment, a door opens and the smart bin will accept the phone
- if other objects are detected, or if the bin is full, the door will not open
- a receipt for the value of the used phone is printed as a redeemable voucher against the cost of a new phone.



- (i) Draw a flowchart for the operating sequence of the smart bin.
- (ii) Name **two** sensors required for the smart bin to operate.
- (iii) Suggest a modification to your flowchart to allow the smart bin to accept the phone and the battery separately.

Answer 1(c) or 1(d)

1(c) According to *Waste Management World*, "Intelligent robotic systems can process almost any given waste stream and sorting capabilities can be redefined for every new market situation."

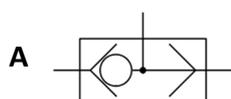
- (i) Name and describe the main features of a waste sorting robot such as that shown.
- (ii) Explain the function of *encoders* in robotic control.



OR

1(d) Pneumatic waste compactors are used to reduce bulk and lessen storage space.

- (i) Outline **two** reasons for the use of pneumatic control in compactor systems.
- (ii) Distinguish between the functions of the pneumatic components whose symbols are shown at **A** and **B**.



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

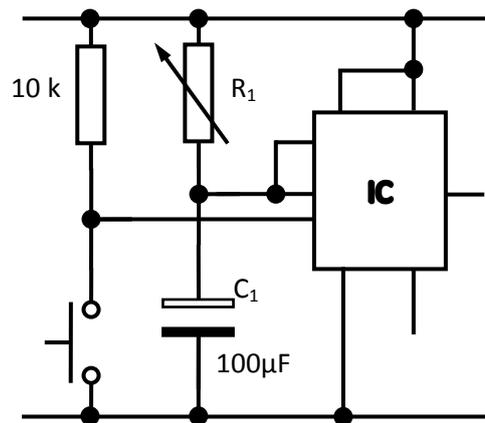
2(a) Sports and other activities can be enhanced through the integration of appropriate technologies such as the analogue chess timer shown.



- (i) Describe how a seven-segment LED display could improve the chess timer.
- (ii) Describe **one** function of a capacitor in a timer circuit.

2(b) The 555 timer IC has a DIL layout and is used in the incomplete circuit for a game timer shown.

- (i) Explain the terms IC and DIL.
- (ii) Name a suitable output transducer (device) and describe the operation of the timer circuit.
- (iii) Calculate the value setting for R_1 to produce a 30 second pulse duration (t).



Note: $t = 1.1 \times R_1 \times C_1$

Answer 2(c) or 2(d)

2(c) The range of npn transistors shown in the table below is available to a circuit designer.

- (i) Select the most suitable transistor from the table to provide a collector current of 60 mA if the base current is 0.4 mA. Give a reason for your answer.
- (ii) Name and explain the function of the transistor arrangement shown in Fig. 1.

Transistor	Current Gain
BC107	100-450
BFY51	40
TIP31	10-60
2N3055	20-70

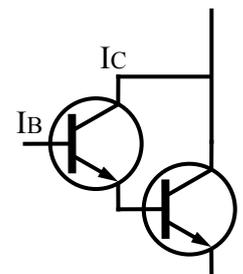


Fig. 1

OR

2(d) An electric cut-off saw is shown. There are sensors connected to the safety guard, the machine vice and the dust extraction system of the saw.

- (i) Using logic gates, draw a circuit that could be used to control the saw.
- (ii) Suggest a suitable sensor for use with the safety guard of the saw.



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

3(a) Virtual reality (VR) can be described as a computer-generated simulation of a three-dimensional environment that can be interacted with in a seemingly real or physical way by a person using electronic sensors.

Explain, with examples, how virtual reality technology has applications in **any two** of the following:

- entertainment
- education and training
- marketing and advertising.



3(b) (i) “From the moment you first post online you are creating an indelible digital fingerprint which will be with you throughout your life...and possibly beyond.”

In light of the above statement, suggest **three** best practice guidelines for a user of online services.

(ii) Describe, with examples, the use of **any two** of the following advanced search operators:

- * (asterisk)
- + (plus symbol)
- “ ” (quotation marks)

(iii) Outline the role of a *firewall* in network security.

Answer 3(c) or 3(d)

3(c) (i) List **three** tasks for a network administrator when setting up and maintaining a computer network.

(ii) Outline the main features of a *client-server network* **and** a *peer-to-peer network*.

OR

3(d) Drones can be used to film situations where manned flight is considered too risky or difficult.

Some cameras can now capture video in up to 4K at 30 fps or *Full HD 1080p* at 120 fps.

(i) Explain the term Full HD 1080p.

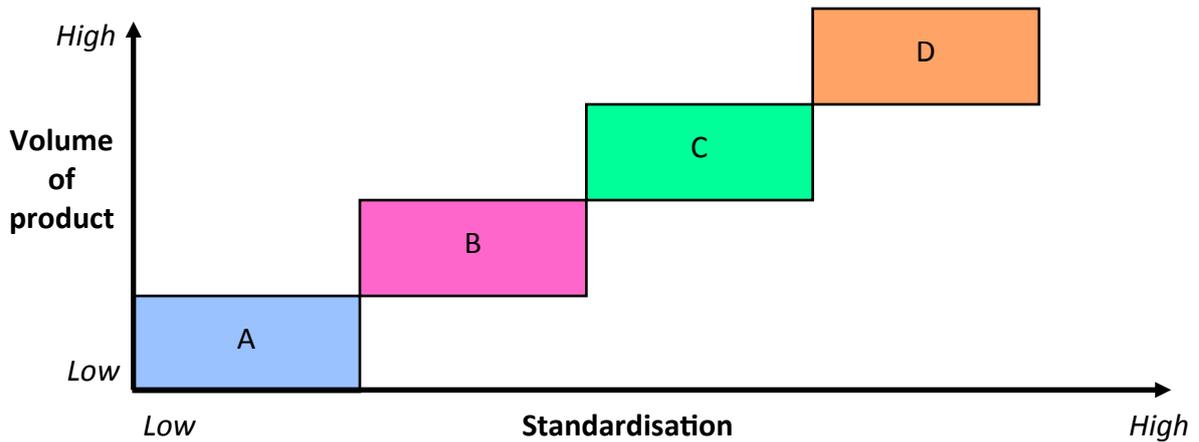
(ii) Differentiate between video at 30 fps and video at 120 fps.



Answer 4(c) or 4(d)

4(c) The Product-Process Matrix links standardisation and product volume in the selection of optimum production techniques.

(i) Name production processes corresponding to A, B, C and D of the matrix shown.



(ii) Distinguish between the *business strategy* and the *manufacturing strategy* of a medical devices firm.

OR

4(d) An engineering firm is in the process of analysing costs for the production of lightweight metal panels. There is a choice between solid panels or thinner sheets that are subject to extra fabrication by folding stiffening ribs to strengthen the panel.

Production costs for the panels are divided into *fixed costs* and *variable costs*.

(i) Explain, with specific examples, the distinction between fixed costs and variable costs.

(ii) The analysis of costs produced the following results:

	Solid panels	Stiffened panels
Fixed costs	€500	€1000
Variable costs	€3 per unit	€2 per unit

Represent the key features of this data to analyse production costs for up to 1000 panels.

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

5(a) The strength of materials can be regarded as the ability to withstand the various forces exerted on them. Woods, metals and plastics can be formulated or fabricated to increase strength.

- (i) Differentiate between the forces of tension, compression and torsion.
- (ii) Describe, with examples, how metal alloys **and** manufactured boards can increase the strength of the final material.

5(b) *Glulam* or glued laminate consists of layers of timber bonded together with durable, moisture resistant adhesive. It is frequently used in structural construction and ship building.

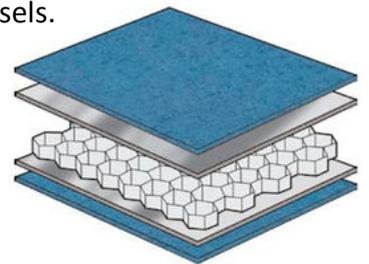


- (i) Describe, using annotated sketches, how an arched structure such as that shown may be fabricated.
- (ii) Describe, using annotated sketches, how metal nodes could be used to join a wooden structure.
- (iii) Explain the use of *triangulation* to make structures stronger.

Answer 5(c) or 5(d)

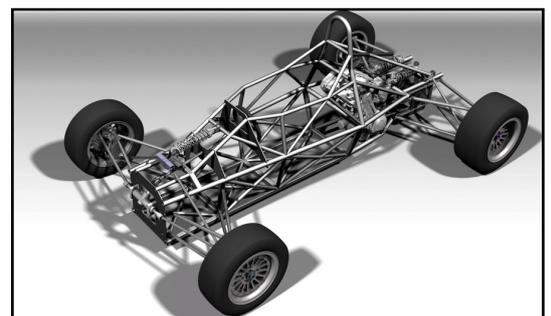
5(c) The aluminium honeycomb material shown is used in panels for marine vessels. It can be fabricated in sheets from 6 mm to 80 mm in thickness.

- (i) Outline **two** advantages of using this material in marine applications.
- (ii) Describe the role of the aluminium honeycomb structure in the design of this material.



OR

- 5(d)**
- (i) State **two** reasons for using steel tubing in the construction of racing cars.
 - (ii) Outline some benefits to consumers and to the environment of the increasing use of electric cars.



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