



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination 2025

Engineering

Common Level

Friday 13 June Afternoon 1:30 - 3:00

120 marks

Examination Number

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Date of Birth

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

Centre Stamp

Instructions

Answer all questions.

Questions do not necessarily carry equal marks.

Write your answers in blue or black pen. You may use pencil and colouring pencils for sketches and diagrams only.

Write your answers in the spaces provided in this booklet. There is space for extra work at the end of this booklet. Label any such extra work clearly with the question number and part.

This examination booklet 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.

Question 1

(a) An outdoor light fitted with a Light Emitting Diode (LED) is shown.

(i) Name one suitable material for the manufacture of the body of the outdoor light shown.

Material:

(ii) State one reason for the selection of your chosen material.

Reason for selection:

(iii) Describe two advantages of using LED lighting.

Advantage 1:

Advantage 2:

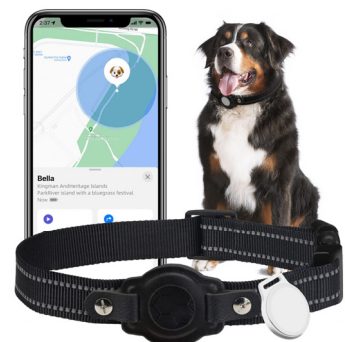


Outdoor LED light

(b) The *smart pet collar* shown uses Global Positioning System (GPS) technology.

(i) Describe one advantage of using GPS technology in a pet collar.

Description:



Smart pet collar

(ii) State one other application of GPS technology.

Application:

(c) The fishing rod shown is made from carbon fibre and has a foam handle.

(i) State two reasons for using carbon fibre for the manufacture of the fishing rod shown.

Reason 1:

Reason 2:

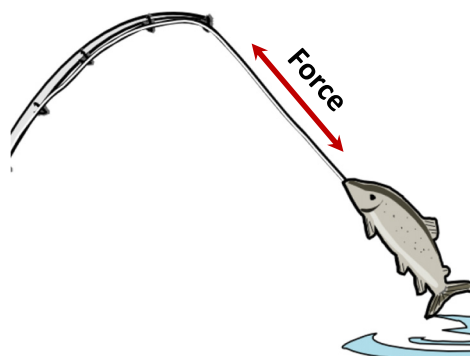


(ii) Explain why foam is used for the handle of the fishing rod.

Explanation:

(iii) Select the type of force acting on the fishing line shown.

Type of force	Selection (tick one)
Compression Force	
Tension Force	
Shear Force	



(iv) Metal fishing weights are often attached to a fishing line to help the bait to sink.

Name one metal which would be suitable for the manufacture of fishing weights.

Name of metal:



(d) A DPDT switch is used to raise or lower the motorised window blind shown.

(i) Explain the meaning of DPDT.

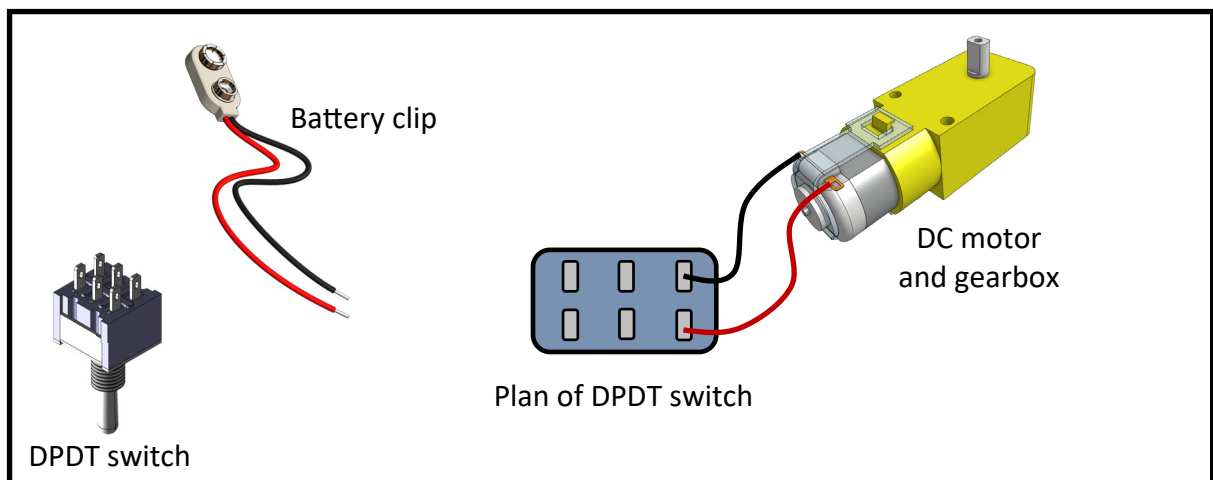
Explanation:



Window blind

(ii) A battery clip, DPDT switch and a DC motor and gearbox are shown below.

Complete the wiring circuit for these components so that the DC motor and gearbox will operate in forward and reverse.



(e) (i) Explain why prototyping is important in the early stages of engineering design and development.

Explanation:



A clay prototype helmet designed by Spiuk

(ii) State one reason for using a 'Gantt Chart' to manage an engineering project.

Reason:



Sample Gantt Chart

Question 2

Engineering plays an important role in the broadcasting of sport, the development of sporting equipment and the celebration of sporting achievements.

- (a) The AGITO multi-terrain robotic broadcasting camera system is shown opposite.

- (i) Name three lathe processes used for the manufacture of the camera thumb screw shown.

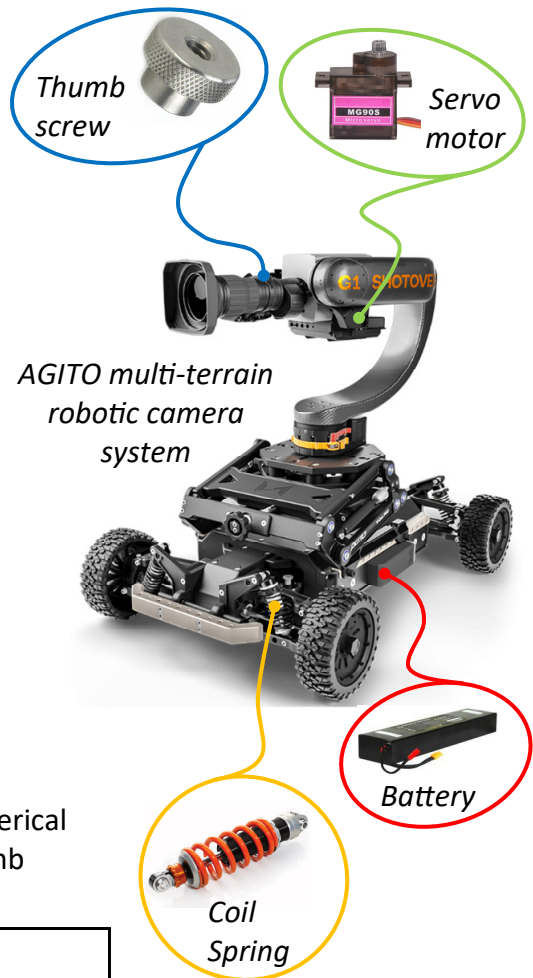
Lathe process 1:

Lathe process 2:

Lathe process 3:

- (ii) State one advantage of using Computer Numerical Control (CNC) in the manufacture of the thumb screw shown.

Advantage:



- (b) Outline one advantage and one disadvantage of using robotic cameras for sports broadcasting events.

Advantage:

Disadvantage:



(c) The robotic camera is powered by a 3.7 V Lithium-ion rechargeable battery.

(i) Explain the meaning of the term 3.7 V.

Explanation:



3.7 V Lithium-ion rechargeable battery

(ii) Outline one benefit of having a rechargeable battery in the robotic camera system.

Benefit:

(iii) Explain why a servo motor is suitable to control the movements of a robotic camera.

Explanation:



Servo motor

(iv) Describe the function of the coil spring in the operation of the robotic camera system.

Description:



Coil spring

(d) The Skycam shown is operated by fibre optic cables which are covered with Kevlar.

(i) Explain why Kevlar is a suitable material for covering a fibre optic cable.

Explanation:



Skycam

(ii) State one other application of fibre optic cables.

Application:



Kevlar covered
fibre optic cable

(e) (i) Select the most suitable polymer for the manufacture of a tennis net.

Polymer	Selection (tick one)
Acrylic	
Polyethylene	
Bakelite	



Tennis net

(ii) Explain why the material you selected in (e)(i) above is suitable for use as a tennis net.

Explanation:



- (f) Sports competitors finishing in the first three positions are presented with Gold, Silver or Bronze medals.



- (i) Name two metals that combine to produce bronze.

Metal 1:

Metal 2:



*Bronze
Olympic
Medal*

- (ii) Using rendered sketching, design a display stand for the medal shown.

Rendered sketch of display stand



Question 3

The Doosan electrically powered concept forklift is a futuristic and innovative design, incorporating features such as joystick control, solar control cabin glass, operator presence system and proximity sensors.



Doosan electrically powered concept forklift

- (a) The materials used in the manufacture of the Doosan concept forklift have the following properties:

Hardness	Toughness
Transparency	Elasticity

Complete the table below by inserting the most suitable material property, from the list above, next to the description of the material property.

Material Property	Description of Material Property
	The ability of a material to allow light to completely pass through.
	The ability of a material to withstand surface indentation, scratching and wear.
	The ability of a material to return to its normal shape after being stretched or compressed.
	The ability of a material to withstand shock and impact.

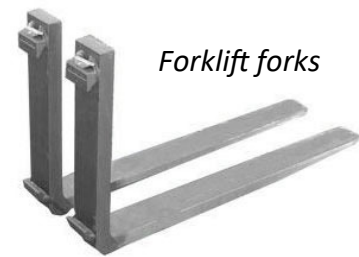
- (b) Identify one advantage and one disadvantage of using electric powered vehicles.

Advantage:

Disadvantage:

- (c) (i) Circle the most suitable material for the manufacture of the forklift forks shown.

Acrylic	Copper	Alloy Steel	Lead
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Forklift forks

- (ii) Explain why the surface of the forklift forks are heat treated.

Explanation:

- (iii) State one safety precaution to be observed when heat treating metals.

Safety precaution:

- (d) The forklift joystick shown is made from the thermoplastic material, High Density Polyethylene (HDPE), and is marked with the polymer identification code shown.

- (i) State one advantage of joystick control systems.

Advantage:



Forklift joystick

- (ii) Explain the meaning of the arrowed lines in the polymer identification code shown.

Explanation:



HDPE

Polymer identification
code

- (e) The cabin of the Doosan electric concept forklift is capable of tilting forward and backwards and is fitted with solar control glass.

- (i) Explain the benefit of a tilting cabin in a forklift.

Explanation:

- (ii) State one reason for fitting solar control glass to the forklift cabin.

Reason:



- (f) The forklift lifting mechanism shown uses a hydraulic ram and chain.

- (i) State one advantage of using a chain in a lifting mechanism.

Advantage:

- (ii) Outline one reason why it is necessary to lubricate a chain mechanism.

Reason:



Forklift lifting mechanism



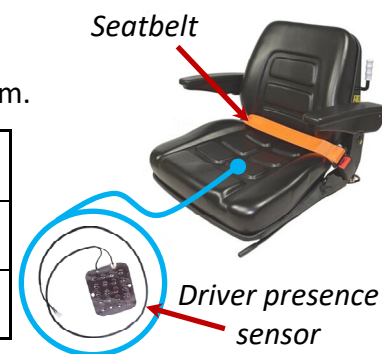
- (iii) Explain the meaning of the term *hydraulic*.

Explanation:

- (g) Modern forklifts are fitted with a seatbelt and an 'Operator Presence System', which senses when the operator (driver) is seated.

- (i) Explain one reason for using an Operator Presence System.

Reason:



- (ii) The following information is relevant to activate the forklift controls:

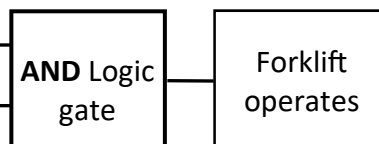
No driver detected = Logic level 0
 Driver detected = Logic level 1
 Seat belt not engaged = Logic level 0
 Seat belt engaged = Logic level 1

Input 1

Driver presence sensor



Input 2
Seatbelt

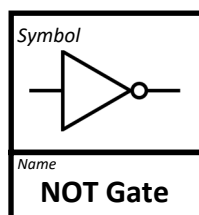


The truth table shown represents the input information outlined above.

Complete the truth table shown.

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

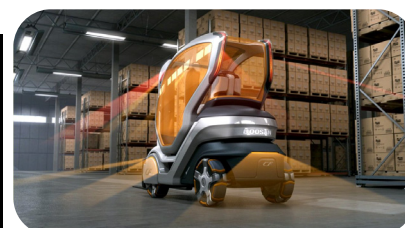
- (iii) A NOT gate is used to invert (reverse) an electronic output.
 Complete the truth table for a NOT gate.



Input	Output
0	
1	

- (iv) Explain the purpose of *proximity sensors* on a forklift.

Purpose:

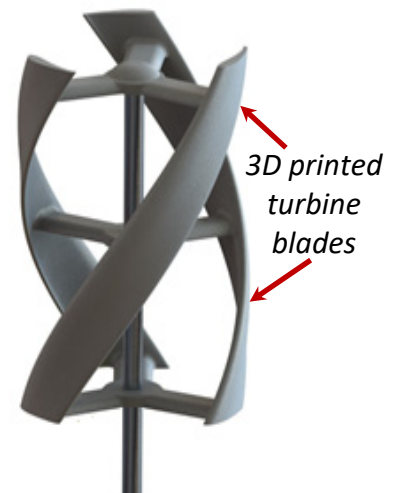


Question 4

(a) 3D printed turbine blades for a *Vertical Axis Wind Turbine* (VAWT) are shown.

(i) Describe the 3D printing process.

Description:



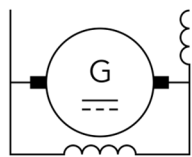
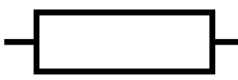
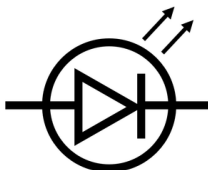
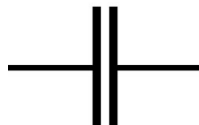
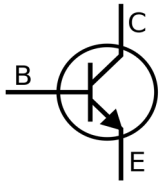
(ii) Using rendered sketching, design a base for the vertical axis wind turbine.

Rendered sketch of vertical axis wind turbine base



(b) The electronic components shown below are used in the electric circuit for the vertical axis wind turbine.

- (i)** A capacitor is matched to its electronic symbol as shown.
Match the remaining electronic components to the correct electronic symbol for that component.

Electronic components	Electronic Symbols
Resistor 	
Transistor 	
DC Generator 	
Light Emitting Diode 	
Capacitor 	

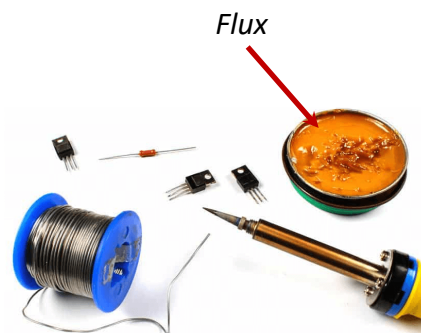
- (ii)** A DC generator is used in the circuit. Explain the meaning of DC.

Explanation:

(c) The electronic components used in the vertical axis wind turbine are joined by soldering.

(i) Describe the function of a flux when soldering.

Description:



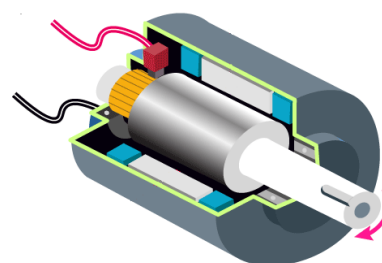
(ii) State two safety precautions to be observed when soldering electronic components.

Safety precaution 1:

Safety precaution 2:

(iii) Select the energy conversion that takes place in a DC generator.

Energy conversion:	Selection (tick one)
Electrical energy to chemical energy	
Mechanical energy to electrical energy	
Kinetic energy to mechanical energy	

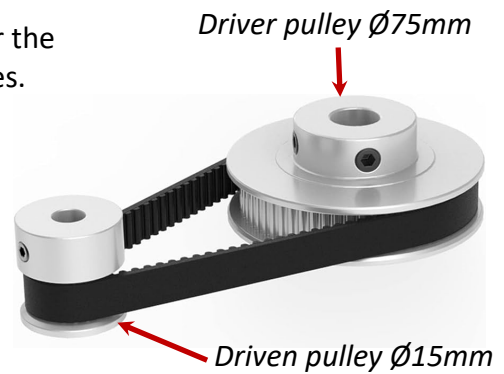


DC Generator

(d) The vertical axis wind turbine uses a toothed belt and pulley drive mechanism.

(i) For the drive mechanism shown, select whether the speed of the driven pulley increases or decreases.

Driven speed	Selection (tick one)
Increased driven pulley speed	
Decreased driven pulley speed	



(ii) Calculate the output speed of the driven pulley, in RPM, if the driver pulley rotates at 50 RPM.

Calculation:

(iii) State the function of the ball bearing used in the vertical axis wind turbine assembly.

Function:



(e) Describe one positive environmental impact and one negative environmental impact of wind turbine technology.

Positive impact:

Negative impact:



Acknowledgements

Question 1 images (Accessed: September 2023)

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<https://www.amazon.com/Waterproof-Location-Tracking-Reflective>
<https://www.daraz.pk/products/multi-color-telescoping-fishing-rod-55-feet>
<https://yonghuang.en.made-in-china.com/product/China-Fishing-Lead-Weight-Fishing>
<https://theelectricblindcompany.co.uk/products/electric-roller-blinds>
<https://grabcad.com/library/9v-battery-clip-connector-2>
<https://grabcad.com/library/toggle-switch-6-pins-dpdt-on-off-on-1>
<https://grabcad.com/library/dc-3v-6v-tt-motor-1>
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Question 2 images (Accessed: October 2023)

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https://d11p0alxbet5ud.cloudfront.net/Pictures/2000x1125/8/0/5/1292805_spidercam_224491.jpg
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Question 3 images (Accessed: October 2023)

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<https://ifdesign.com/ifservice>
<https://www.unitedrentals.com/marketplace/equipment/forklifts/forklift-attachments>
<https://www.alibaba.com/product-detail/Cranes-loaders-Forklifts-excavators-access-platform>
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Question 4 images (Accessed: November 2023)

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<https://harshasnmp.wordpress.com/capacitor>
<https://ie.rs-online.com/web/p/through-hole-resistors>
<https://www.direnc.net/bc141-60v-npn-si-small-signal-transistor>
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