Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination, 2016

Technology

Higher Level

Wednesday, 22 June
Afternoon, 2:00 - 4:00

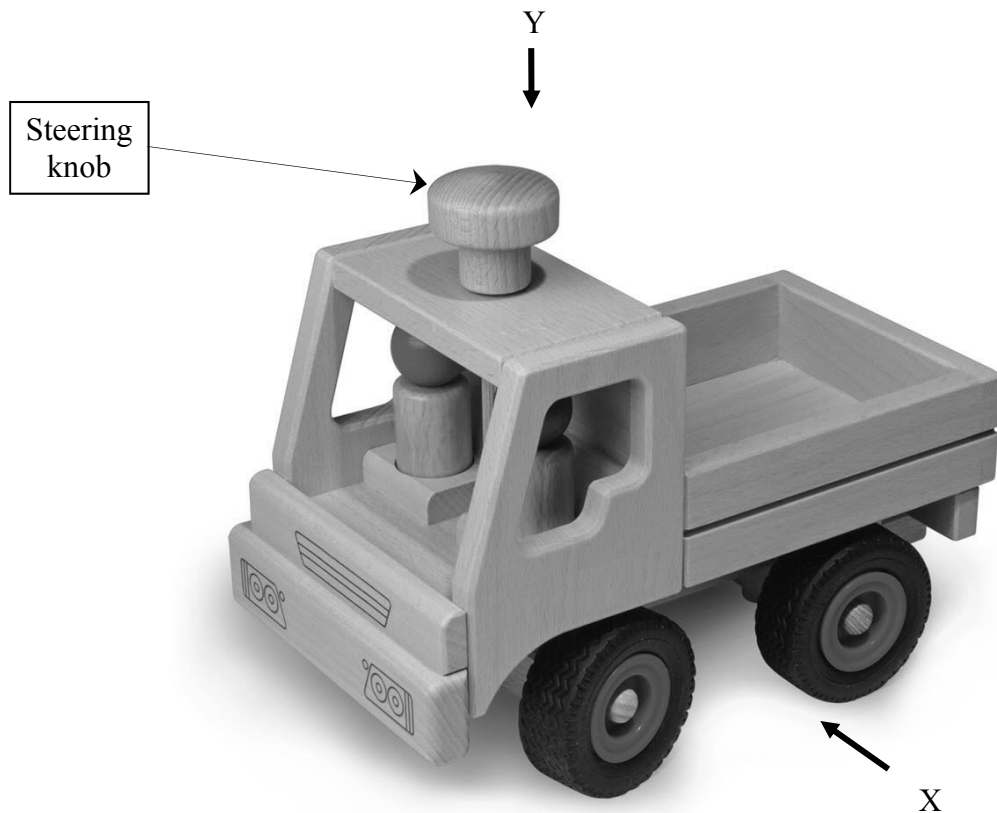## Section B and Section C

Section B   -   50 marks

Section C   -   50 marks

Instructions:

1.   Answer either **(a) or (b)** from each question in **Section B**.

2.   Answer **one** question from **Section C**.

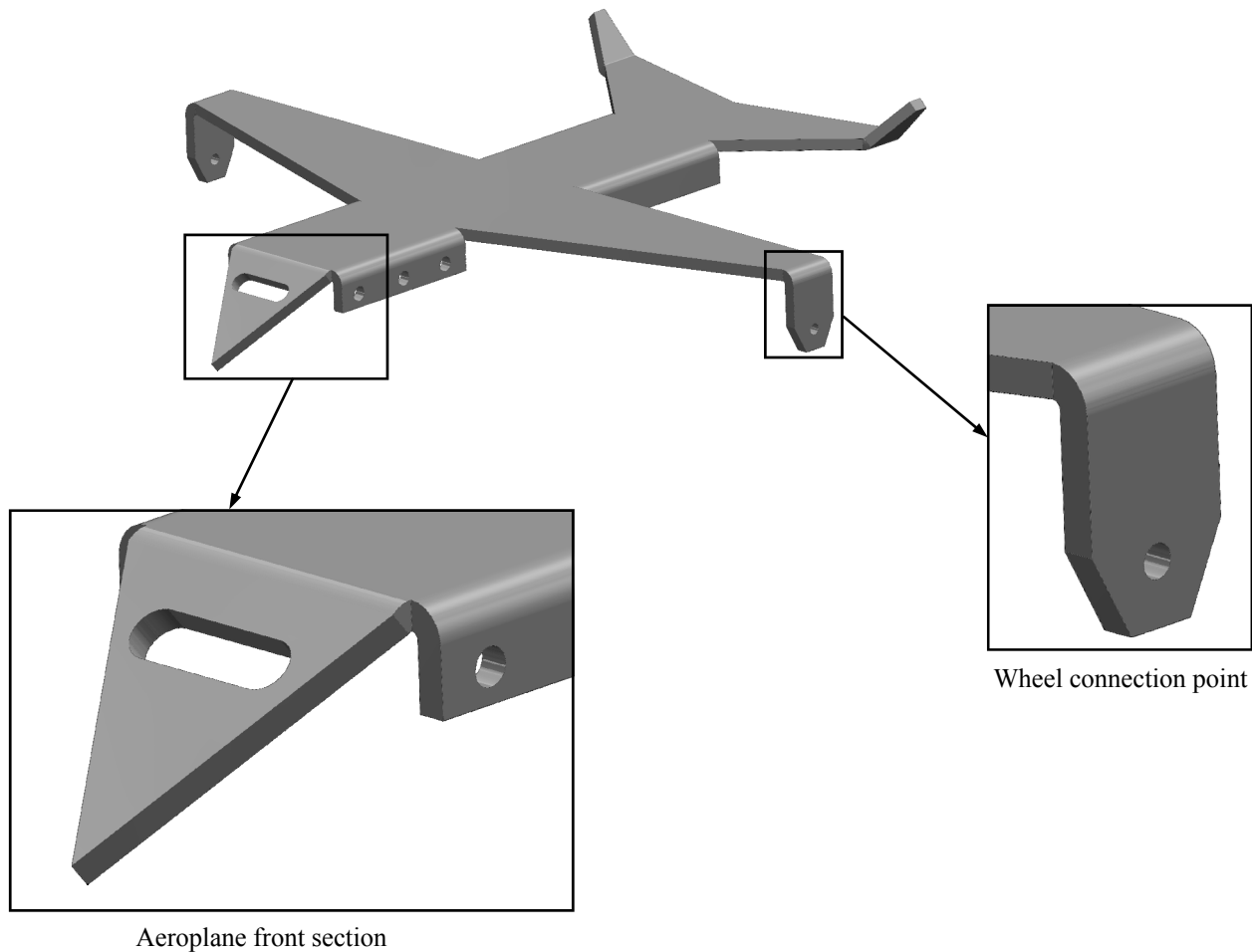3.   Hand up **Section A** with your answer sheets to this paper.

1 (a) The graphic shows a toy truck. The truck is 150 mm long and is made from oak.

Y

Steering
knob

X

    (i)   Make well-proportioned sketches of the following views:

               1.   An **elevation** in the direction of arrow **X**.
                     Note: The driver and passenger need not be included.

               2.   A **plan** in the direction of arrow **Y**.

                                              (10 marks)

    (ii)   1.   Describe, using suitable sketches, how the side window openings
                     could be formed.
                     Name any tools required and state the processes used.

               2.   A windscreen is required for the front of the cab.
                     Describe, using suitable sketches, how to manufacture the windscreen
                     and attach it to the cab.

                                              (10 marks)

    (iii)   The truck steering is controlled by turning the knob on the roof of the cab.
                 Describe, using suitable sketches, how this steering can be achieved.
                 Name any mechanism required.

                                            (5 marks)

1 (b)   The graphics show a design for a toy aeroplane.
          The toy is to be manufactured from a single sheet of 3 mm acrylic.

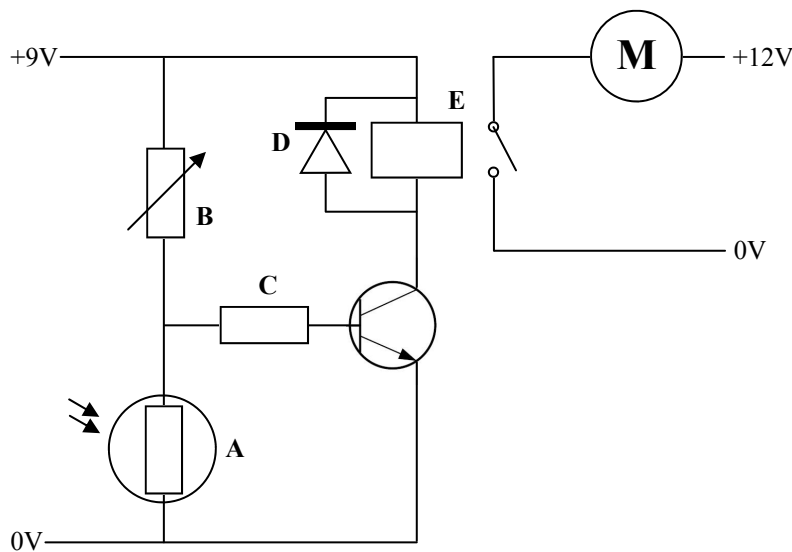Aeroplane front section

Wheel connection point

(i)   Make a well-proportioned sketch of a **development** of the aeroplane.
        Indicate clearly on your sketch the position of all cutting and bend lines.

(10 marks)

(ii)   1.   Explain, using sketches, the steps required to manufacture the
                   aeroplane front section from the 3 mm acrylic sheet.
                   Name any tools required and state the processes used.

            2.   Describe, using sketches, how a suitable wheel could be attached
                   to the aeroplane at the wheel connection point shown.

(10 marks)

(iii)   A design modification is required to prevent damage to the nose of the aeroplane,
        when the aeroplane is pushed along the ground.
        Describe, using sketches, a suitable nose skid to solve this problem.
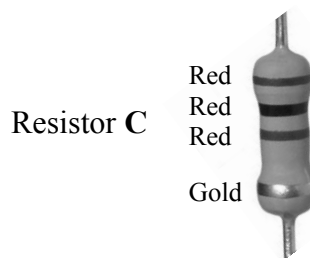
(5 marks)

2 (a) The circuit design shown is to be used in a novelty money box.

The following actions will be performed by the circuit when a coin is placed on the sensor:
- Sensor circuit activated,
- Motor turns,
- Arm of toy cat (attached to motor) draws coin into box,
- Sensor circuit deactivated,
- Motor stops.

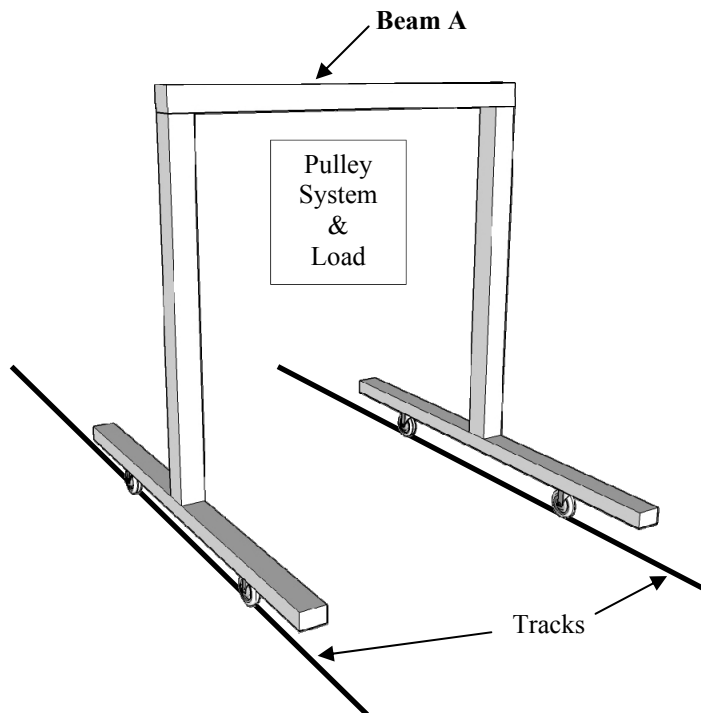**Novelty Money Box**

Coin   Sensor

Resistor **C**

Red
Red
Red

Gold

Resistor Colour Codes

Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

(i)   Name the components labelled **A** and **D** in the circuit.   (6 marks)

(ii) Explain why components **B** and **E** are required in the circuit.   (6 marks)

(iii) Resistor **C** has coloured bands as shown above.
      Using the resistor colour-code table, calculate the value of this
      resistor and state it's tolerance.

                                                                                                        (6 marks)

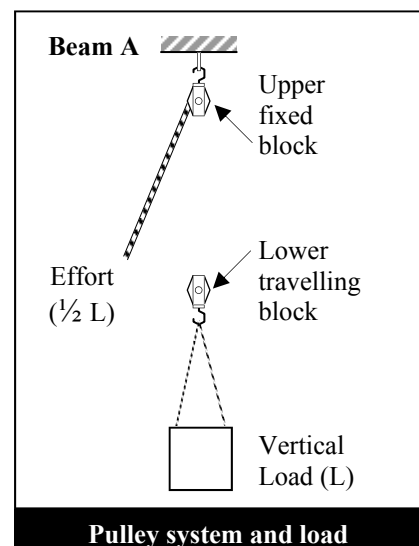(iv) State **one** function of the transistor in this circuit.   (7 marks)

2 (b) The graphic shows a design for a working model of a lightweight workshop gantry crane.
The crane will allow small loads to be lifted and moved around a workshop.

Beam A

Pulley
System
&
Load

Tracks

(i)   Sketch **two** possible cross sections for beam A to support a vertical load.
Your design must ensure the beam is lightweight and will resist bending.   (6 marks)

(ii)   Copy the crane design shown and sketch clearly additional members to:

(a)   further support beam A
and
(b)   increase the stability of the crane.   (6 marks)

(iii)   Sketch and name the parts of a suitable motorised mechanism to move the crane
slowly forward and backward along tracks in the workshop.

(6 marks)

(iv)   The design will use a pulley system to lift small loads.

(a)   Sketch a design for a pulley system which
will require an effort of ½ of the load

and

(b)   includes a mechanism to hold the
raised load at a fixed height.

(7 marks)

Beam A

Upper
fixed
block

Lower
travelling
block

Effort
(½ L)

Vertical
Load (L)

Pulley system and load

Section C - 50 Marks

Answer **one** question from this section – all questions carry equal marks.

This section relates to **Technology & Society**, **Control Systems** and **Design & Manufacture.**

3.   **Technology & Society**

(a)   'Bike-rental schemes have become popular in many large cities. Registered users can collect bikes from, and return bikes to, a number of secure locations around the city. These schemes are encouraged by local authorities and are supported by a smart phone app'.

   (i)   Outline **two** reasons why local authorities encourage people to use these bikes.

   (ii)   Outline **two** ways in which a smart phone app might support this scheme.

   (iii)   Outline **two** technologies needed to operate these schemes.

(30 marks)

(b)   Many consumer products are advertised as including 'Green Technologies'.

   Outline **two** 'Green Technologies' which might be included in consumer products.
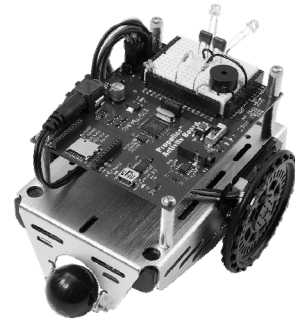
(10 marks)

(c)   Outline **two** ways in which technology is used by today's consumers when buying products.

(10 marks)

4. Control Systems and Technology & Society

(a) The robot shown can be assembled from a kit containing a programmable microcontroller, suitable sensors, two geared motors with drive wheels, a free turning wheel, a battery and a frame.

   (i) Outline the purpose of the microcontroller.

   (ii) Outline how the microcontroller is programmed.

   (iii) Briefly outline how the robot can perform **each** of the following actions:
   - move forward and turn right
   - avoid an obstruction.

   (iv) Sketch a design change necessary to allow the robot to travel over soft ground.
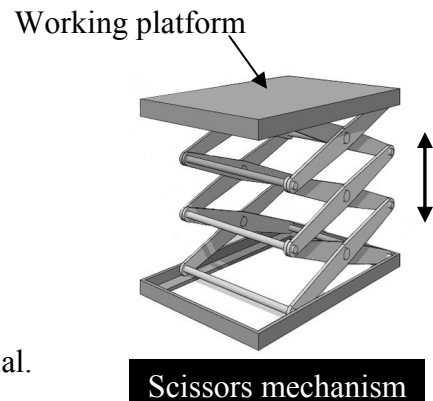
   (30 marks)

(b) Robotic devices are available to perform a variety of tasks.

   (i) Using suitable examples, outline **two** tasks for which robots are well suited.

   (ii) Outline **two** impacts which the increased use of robotic machines could have on society.

   (20 marks)

5. Design & Manufacture

Working platform

A student intends to manufacture a working model of a scissor platform based on the image shown.

(i) Describe, with the aid of sketches, the steps required to manufacture the scissor mechanism from a suitable material.
Name any tools required and state the processes used.
(15 marks)

Scissors mechanism

(ii) Describe, with the aid of sketches, a mechanism to raise and lower the platform. Indicate clearly how to prevent the platform collapsing under load.

(15 marks)

(iii) When the platform was fully raised the model was found to be unstable. Describe **two** modifications to prevent this happening.
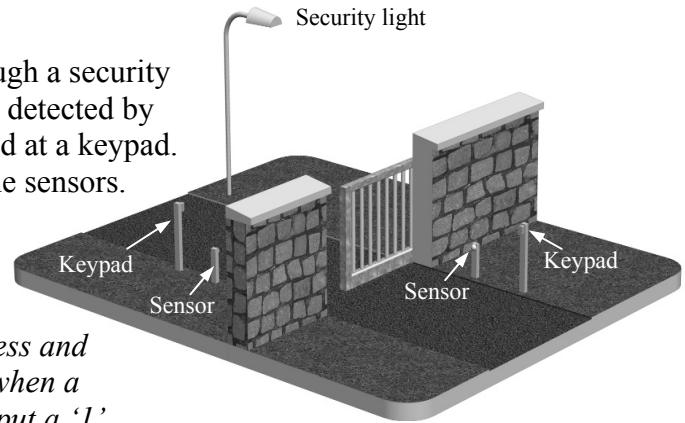
(10 marks)

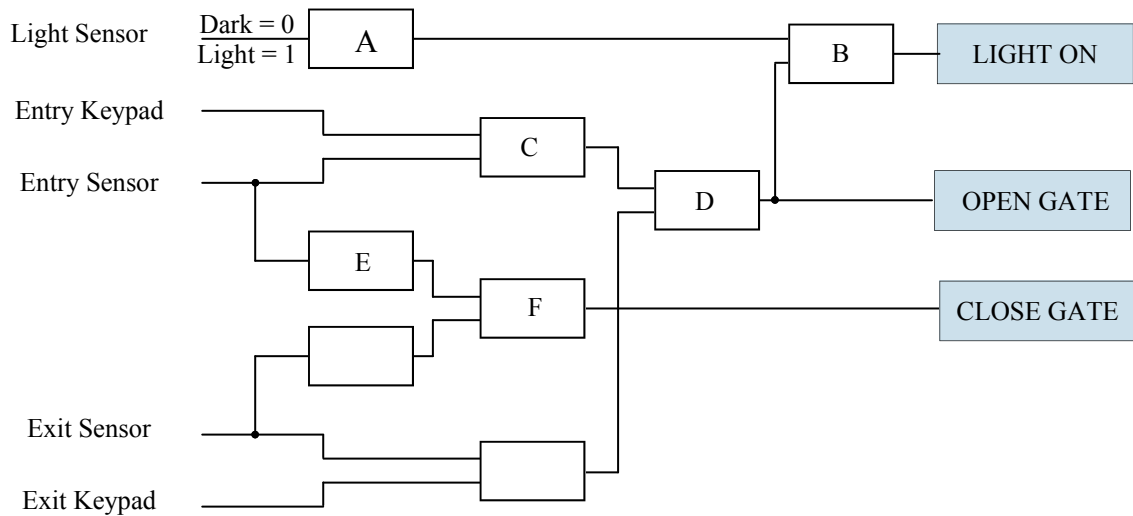(iv) Outline **two** safety features which should be included in the design of the model.

(10 marks)

6. Control Systems

(a) A system diagram, to control entry and exit through a security gate, is shown. The gate will open if a vehicle is detected by the entry or exit sensor and a valid code is entered at a keypad. The gate will close if no vehicle is detected by the sensors. A security light will switch on at night while the gate is opening.
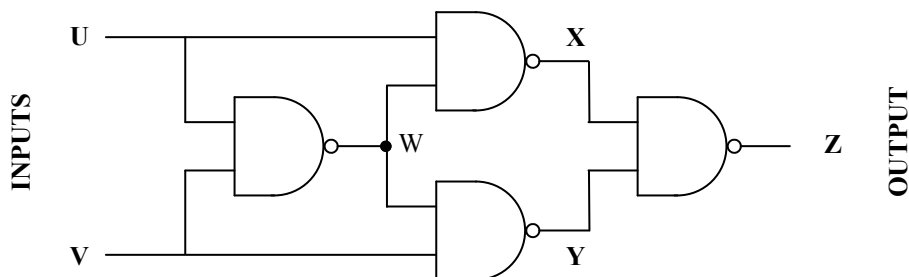
Note: The light sensor will output a '0' in darkness and a '1' in daylight. The keypads will output a '1' when a valid code is entered. The entry sensors will output a '1' if a vehicle is detected.

(i) Name the logic gates required at A, B, C, D, E and F.
(ii) Draw a truth table for the logic gates at C and at D.

(26 marks)

(b) A NAND gate is a combination of an AND gate and a NOT gate. NAND gates can be combined to form other logic gates.

Copy the truth table below into your answerbook.
Complete the table for the inputs shown.

Input U	Input V	W	X	Y	Output Z
1	1				
1	0				

(24 marks)