Surname

Other Names

Candidate Signature

General Certificate of Secondary Education
June 2011

Engineering Unit 3 48503

Application of Technology

Friday 20 May 2011   9.00 am to 10.00 am

For this paper you must have:
● normal writing and drawing instruments.

Time allowed
● 1 hour

Instructions
● Use black ink or black ball-point pen. Use pencil only for drawing.
● Fill in the boxes at the top of this page.
● Answer **all** questions.
● You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
● Do all rough work in this book. Cross through any work you do not want to be marked.

Information
● The marks for questions are shown in brackets.
● The maximum mark for this paper is 75.
● You are reminded of the need for good English and clear presentation in your answers. Quality of Written Communication will be assessed in Question 8.

Answer **all** questions in the spaces provided.

1 (a) The Pictorial view of the component shown in **Figure 1** has been redrawn, as an orthographic projection, in **Figure 2**. However one of the views is missing.

Figure 1
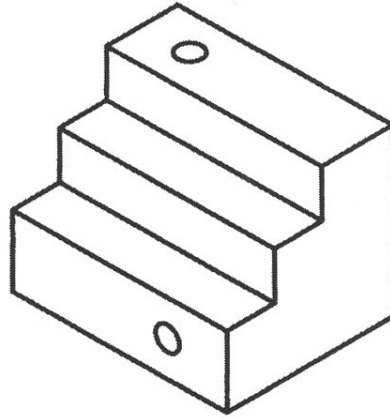
Figure 2
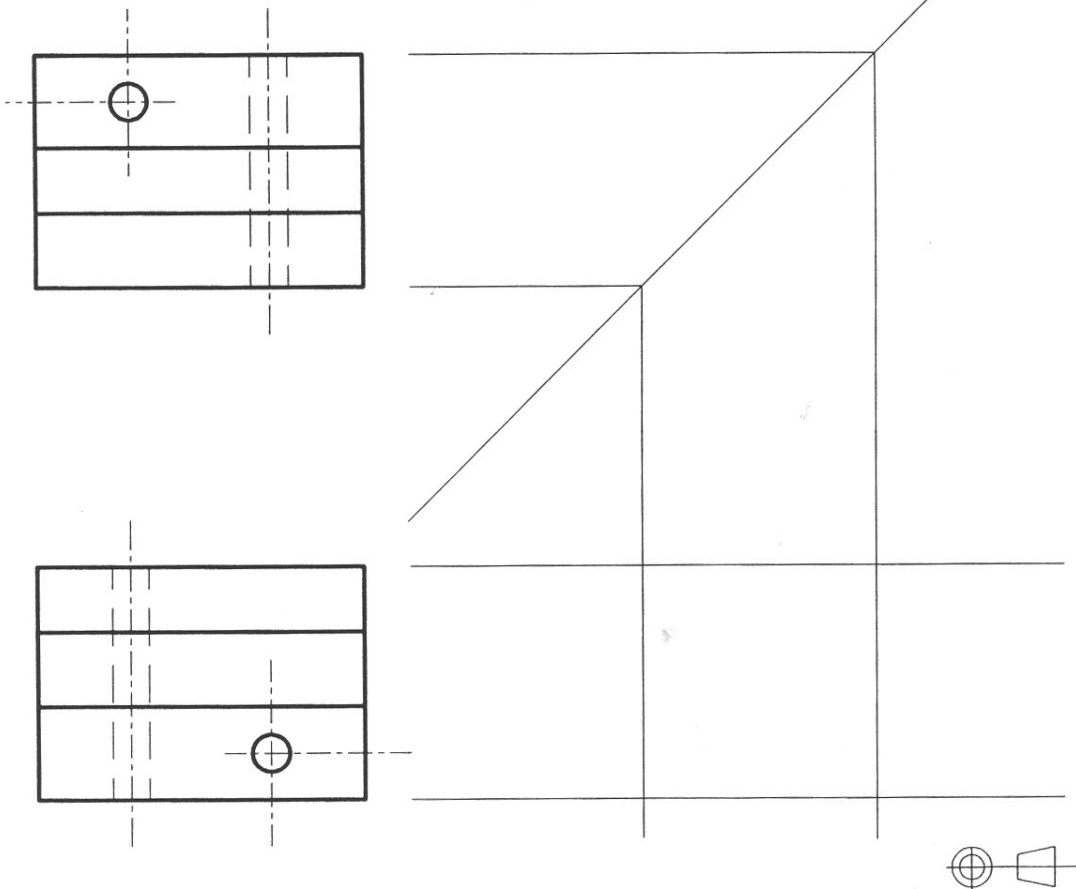
1 (a) (i) Complete the missing view in the space provided above showing all the detail.

(6 marks)

0 2

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1 (a) (ii) What type of pictorial drawing is **Figure 1**? Tick the correct box.

Isometric	
Oblique	

(1 mark)

1 (a) (iii) What type of orthographic drawing is **Figure 2**? Tick the correct box.

Exploded Diagram	
Third Angle Projection	

(1 mark)

Question 1 continues on the next page

1 (b)   The component shown in **Figure 1** has been modified to be used as steps for a caravan. The details are shown in **Figure 3** below. It is to be made in three parts from 2 mm mild (low carbon) steel sheet.

Figure 3
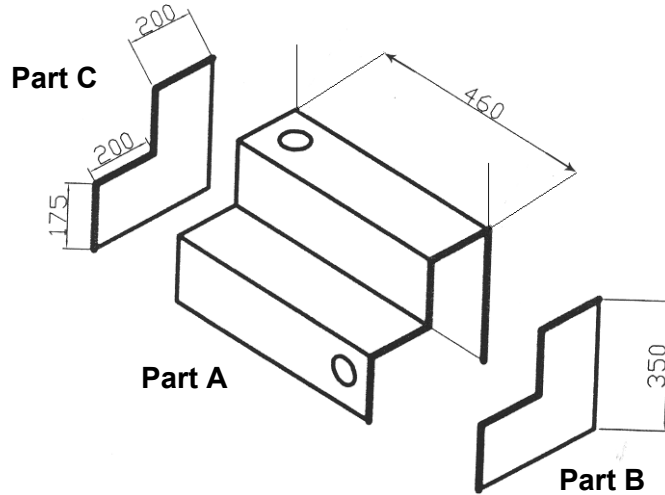
1 (b) (i)   Part A is to be made from a single sheet of metal, 460 mm wide and bent to the required shape. From the information in **Figure 3**, calculate the total length required (ignore the bends). Show your calculations in the box below.

Total length required...

(3 marks)

1 (b) (ii) Part A is to be cut from a standard sheet size of 1.25 m × 2.5 m.
How many pieces can be cut from the sheet to minimise waste material?
Show your calculations in the box below.

Maximum number of pieces per sheet ....

(4 marks)

1 (b) (iii) What type of machines would be used to cut the sheet and produce the holes in Part A?

Cut the sheet ....

Produce the holes...

(2 marks)

17

Turn over for the next question

Turn over ▶

2 (a) The caravan steps, shown in **Figure 3** on page 4, are to be made from mild (low carbon) steel which may corrode if left untreated.
Identify **and** describe **one** industrial process, *other than painting*, of preventing this.

2 (a) (i) Process ....

(1 mark)

2 (a) (ii) Description of process

....

....

....

....

(3 marks)

2 (a) (iii) State **one** reason why painting had not been considered.

....

....

(1 mark)

2 (b) State **two** health and safety hazards to be considered when performing the process you have described in part (a) and say how to minimise the risk of harm caused by each of them.

2 (b) (i) Hazard 1 ....

How can the risk of harm caused by the hazard be minimised?

....

....

....

(2 marks)

2 (b) (ii) Hazard 2 ....

How can the risk of harm caused by the hazard be minimised?

....

....

....

(2 marks)

2 (c) Give **two** reasons why mild (low carbon) steel has been chosen for the caravan steps.

1 ....

....

2 ....

....

(2 marks)

11

Turn over for the next question

Turn over ▶

3 Complete the production flow chart, for the component shown in **Figure 3** on page 4 using the symbols given at the bottom of the page.

Merge

Finish
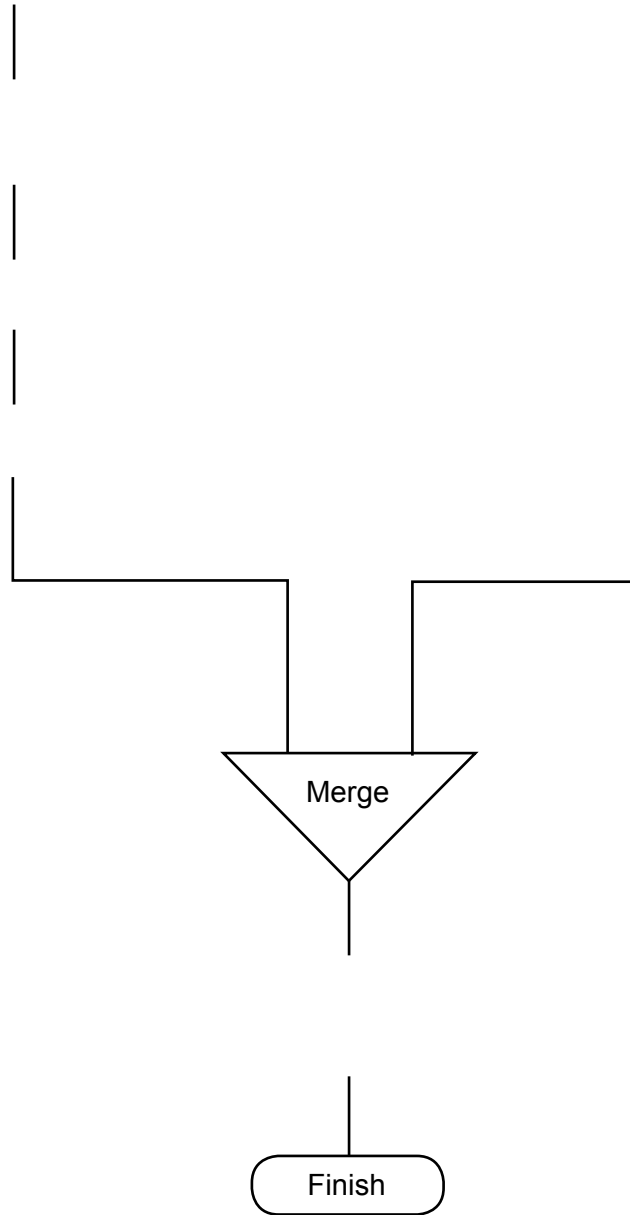
Bend to shape

Mark out bend lines and holes

Make holes

Assemble parts and weld together

Start Part A

Start parts B and C

Laser cut both Parts B and C

(7 marks)

7

4 The simple circuit, shown in **Figure 4** below, contains electronic components shown as symbols.

Figure 4 Flashing circuit
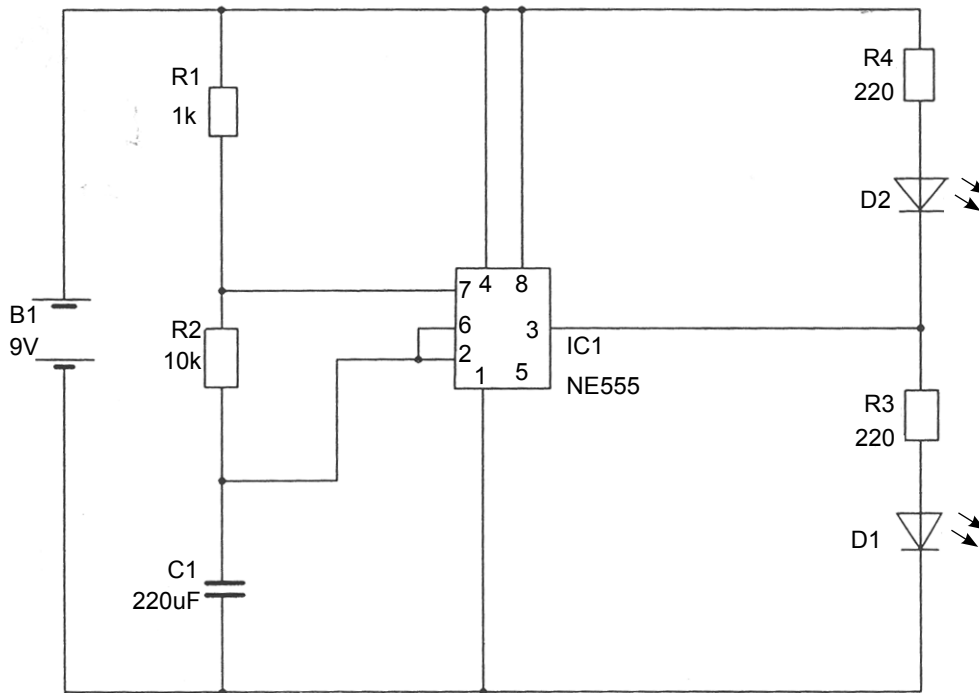
4 (a) Name the following components and symbols.

D2 ....

C1 ....

R3 ....

B1..

(4 marks)

4 (b) Describe what the component labelled **IC1 NE555** does in the circuit in **Figure 4**.

....

....

....

....

(2 marks)

6

Turn over ▶

5 (a)   The diagram below shows the arrangement of a CNC milling machine, and its three axes.
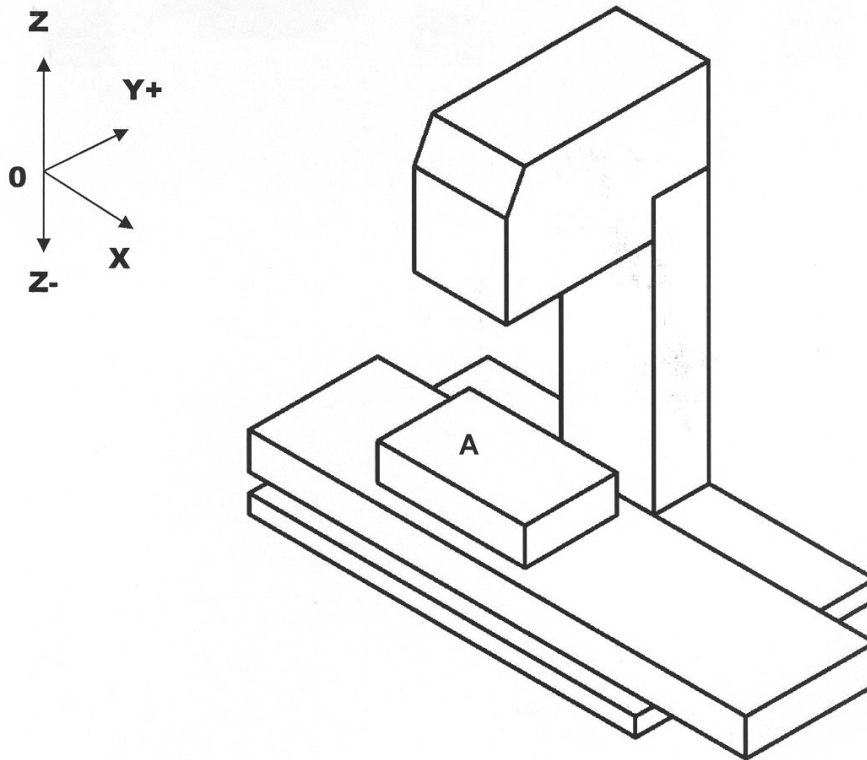
The block of material to be machined is shown as **A** in the diagram above.
Complete the table on the page opposite to work out the coordinates to which the cutter needs to go to *start* cutting, **and** the coordinates to which it needs to go to *finish* the cut. The table relates to the moves necessary to drill the holes in the Blank, shown below in **Figure 5**.

Figure 5 Blank for Caravan Steps
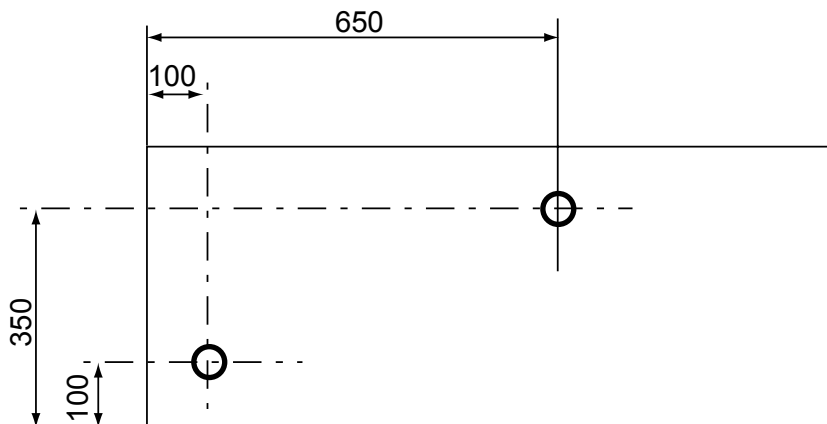
Datum: lower left hand corner (LLHC)   Thickness: 2 mm
Dia of holes: 10 mm

Operation	x coordinate	y coordinate	z coordinate
Move to start	+100	+100	+15
Plunge to depth		+100	−3
Raise cutter	+100		+15
Move to	+650	+350	+15
Plunge to depth	+650		
Raise cutter		+350	+15
Return to datum	0	0	

(6 marks)

5 (b) (i) Explain how CAD/CAM could be used to produce the drilled holes in **Figure 5**.

....

....

....

....

(2 marks)

5 (b) (ii) What precautions should be taken before running a new CNC Part Program to manufacture a batch of 1000 components? You should give **two** examples in your answer.

....

....

....

....

(2 marks)

5 (c) Explain **one** method of protecting the operator when using a CNC milling machine.

....

....

....

....

(2 marks)

12

Turn over ▶

6 (a) Engineering companies use robotic systems to interact with CNC machines for production and inspection.
Give **two** examples of the industrial use of robots in manufacturing.

Example 1 .... M/Jun11/48503

....

....

....

Example 2 ....

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(4 marks)

6 (b) Explain the difference between Computer Integrated Manufacturing (CIM) and CAD/CAM.

....

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(2 marks)

6

7 (a) Industrial Control Systems (ICS) has a wide range of applications such as the operation of a remote oil pipeline valve from a central control room.
Give **two** examples how ICS could operate in a modern factory.

1 ....

....

....

....

2 ....

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....

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(4 marks)

7 (b) Give **two** examples of the application of *smart materials* in engineering.

1 ....

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2 ....

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(4 marks)

8

Turn over for the next question

Turn over ▶

8 (a) Discuss the advantages and disadvantages associated with burning fossil fuels in power stations.

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(4 marks)

8 (b) Explain, giving **two** examples, how a company can contribute to a responsible system of recycling and waste management.

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(4 marks)

8

END OF QUESTIONS

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