



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
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**DESIGN AND TECHNOLOGY**

**0445/04**

Paper 4 Systems and Control

**October/November 2007**

**1 hour**

Candidates answer on the Question Paper.

No Additional Materials are required.

**To be taken together with Paper 1 in one session of 2 hours 15 minutes.**

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

**Section A**

Answer **all** questions.

**Section B**

Answer **one** question.

You may use a calculator.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
Total	

This document consists of **14** printed pages and **2** blank pages.



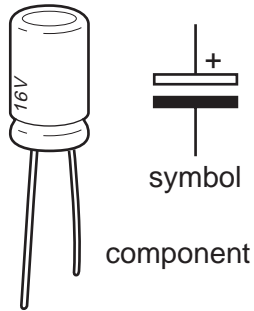
**Section A**

Answer **all** questions in this section.

1 Complete the statement below:

A tie is a structural member experiencing ..... force. [1]

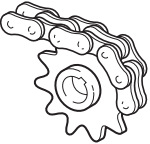
2 Identify the electrical component shown below.



The component shown is ..... [2]

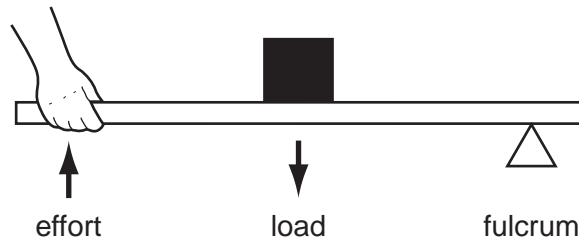
Give one use of this component. .... [1]

3 Complete the table below.

Name	Diagram	Use
Pear cam and flat follower		Valve operation
		Bicycle transmission

[3]

4 Identify the class (order) of lever shown below:

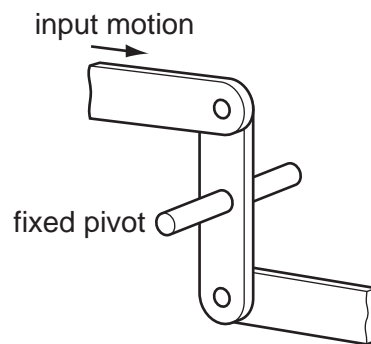


The lever shown is ..... [1]

Give an example of the use of this class of lever.

..... [1]

5 The diagram below shows a linkage.



(a) Add labels to show the direction of the output motion. [2]

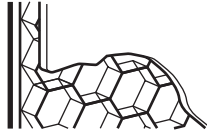
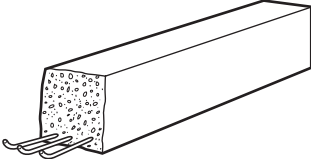
(b) Name the type of motion shown in the diagram of the linkage above.

..... [1]

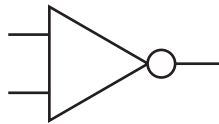
(c) Explain the function of this linkage.

..... [2]

6 Complete the table below.

Name	Diagram	Use
Honeycomb cells		[1]
[1]		[1]
'I' Section beam	[2]	Steel framed buildings

7 Identify the logic gate shown in the diagram below.



..... [1]

8 (a) State the purpose of an LDR transducer.

..... [1]

(b) Give **one** example of the use of an LDR.

..... [1]

9 Give **one** example of the use of a strain gauge.

..... [1]

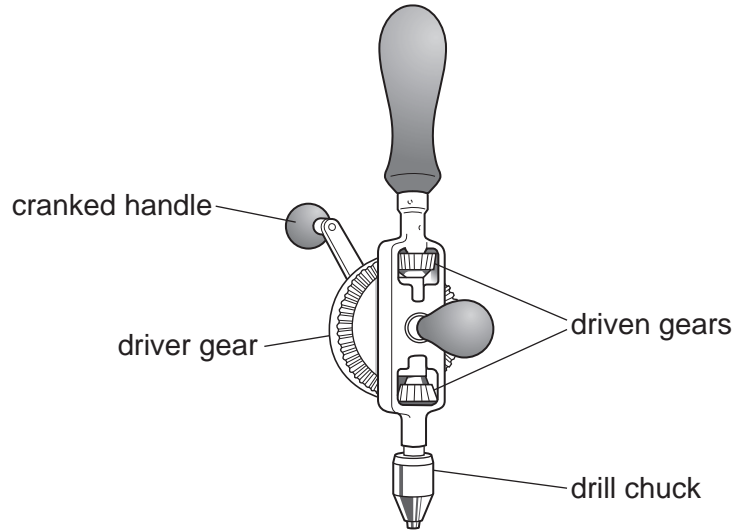
10 Name **two** methods of reinforcing a square framed structure.

..... [2]

**Section B**

Answer **one** question from this section.

**11** Fig.1 shows a hand drill.



**Fig. 1**

**(a)** Describe the motion conversion that takes place when using a hand drill.

.....

.....

.....

..... [2]

**(b) (i)** Name the type of gear mechanism used in the hand drill shown.

..... [1]

**(ii)** Explain why the driver gear wheel is very much larger than the driven gear wheels.

.....

.....

..... [2]

(iii) Give **one** reason for the top driven gear wheel nearest the handle.

.....  
.....  
..... [2]

(c) Explain why the handle is cranked.

.....  
.....  
.....  
.....  
..... [3]

(d) The driver wheel has 60 teeth and the driven wheels have 12 teeth each.

(i) Calculate the gear ratio for this mechanism.

[3]

(ii) If the driver wheel is turned at 60 rpm, calculate the speed of the drill chuck.

[3]

(e) Fig. 2 shows a toothed belt drive arrangement.

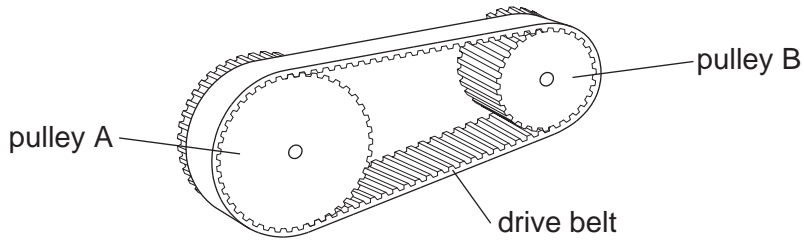


Fig. 2

(i) Give **one** benefit of using this type of belt drive.

.....  
 ..... [1]

(ii) Explain **one** drawback of using this type of belt drive.

.....  
 .....  
 ..... [2]

(iii) Give **one** example of the use of this type of belt drive.

..... [1]

(iv) Explain how you would calculate the Velocity Ratio of this belt drive.

.....  
 .....  
 .....  
 .....  
 ..... [3]

(f) Give **one** other type of pulley drive belt and give **one** use.

.....  
 .....  
 ..... [2]

12 Fig.3 shows a variety of both natural and man made structures.

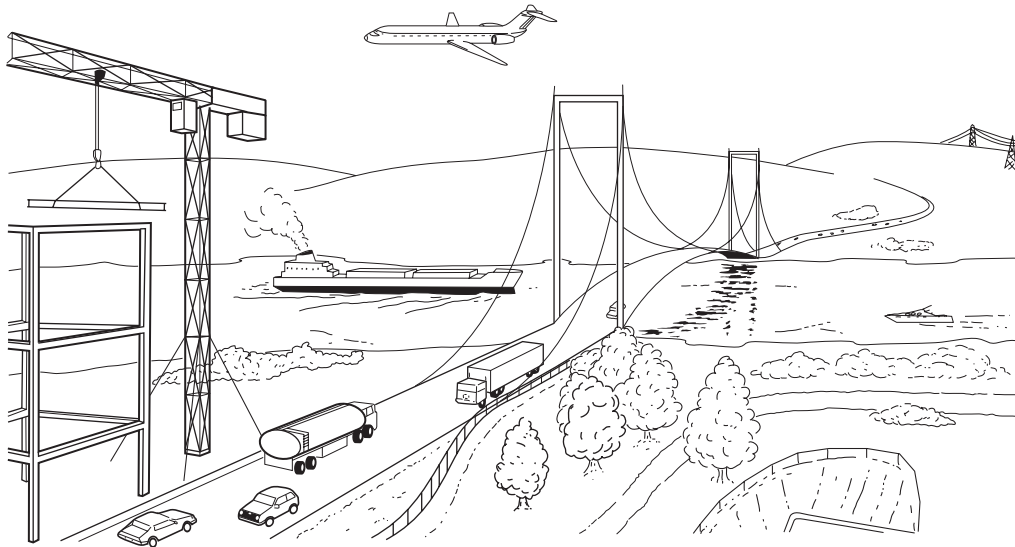


Fig. 3

(a) (i) Name **one** frame structure in Fig.3.

.....  
..... [1]

(ii) Name **one** man made shell structure in Fig.3.

..... [1]

(b) Explain the difference in the way in which frame and shell structures work.

.....  
.....  
.....  
.....  
..... [2]



(c) Explain the following functions of a structure.

Support: .....  
.....  
..... [2]

Span: .....  
.....  
..... [2]

Contain: .....  
.....  
..... [2]

(d) Structures can be subjected to static and dynamic forces.

Explain, using examples, the difference between static and dynamic forces.

.....  
.....  
.....  
.....  
..... [3]

(e) Fig. 4 shows a structure for a roof truss.

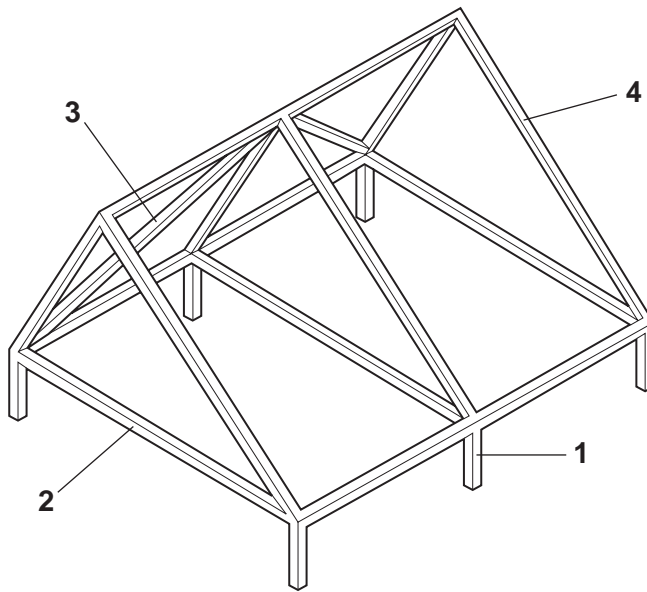


Fig. 4

(i) Name the parts numbered 1 to 3.

- 1 ..... [1]
- 2 ..... [1]
- 3 ..... [1]

(ii) Part 4 is a strut.

Use sketches and notes to explain the type of load experienced by a strut.

[2]

(iii) Use sketches and notes to explain why the roof truss is made up of triangles.

[2]

(iv) Draw **one** method of reinforcing the joints in the roof truss.

[2]

(f) Use notes and sketches to explain the term redundant member.

[3]

13 Fig. 5 shows a counting circuit triggered by a photoswitch.

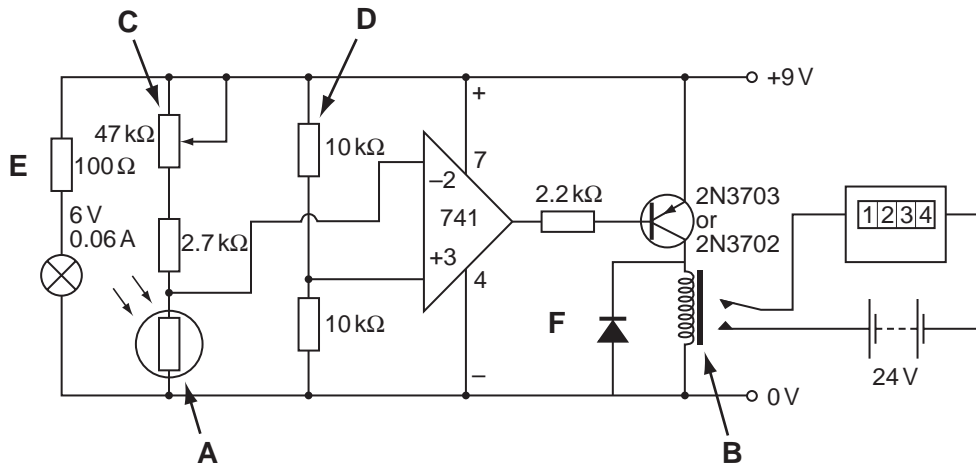
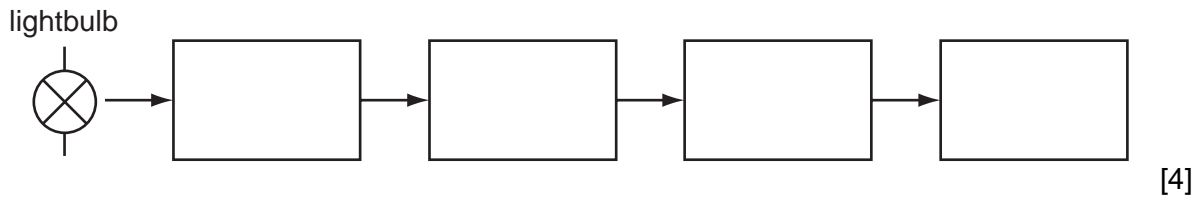


Fig. 5

(a) Complete the block diagram to explain how this counting circuit works each time the light beam, shining on component A, is broken.



(b) (i) Name component B.

..... [1]

(ii) Explain the purpose of component B in this circuit.

.....  
 .....  
 ..... [3]

(iii) Explain the need for component F.

.....  
 .....  
 .....  
 ..... [2]

(iv) Explain the purpose of component **C**.

.....  
.....  
.....  
.....  
..... [3]

(v) State the purpose of the resistor **E**.

.....  
..... [1]

(c) The pair of 10 kΩ resistors labelled **D** are known as a potential divider.

Explain the term potential divider.

.....  
.....  
.....  
..... [3]

(d) Explain how the circuit shown in Fig. 5 could be simply modified to count when the light beam is shining on component **A**.

.....  
.....  
..... [3]

- (e) Logic gates could be used to control a counter. Fig. 6 shows a pressure pad circuit that is used to trigger a counter when a person steps on pad **P** and, at the same time, presses the push button **Q**.

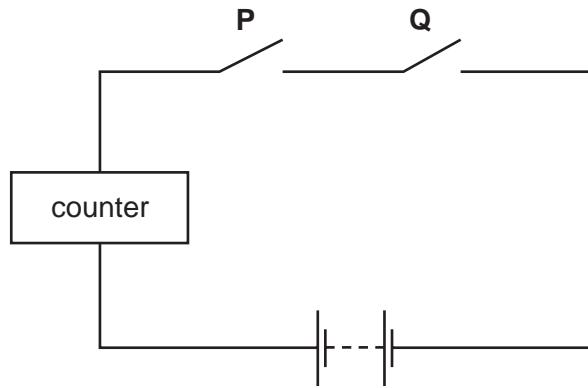


Fig. 6

- (i) Complete the truth table below for this logic circuit.

Pad P On/Off	Pad Q On/Off	Counter state On/Off
Off	Off	Off
Off	On	
On	Off	
		On

[4]

- (ii) Identify the type of logic circuit shown.

.....

[1]



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