

**PRINCIPAL LEARNING
LEVEL 3**

ENGINEERING

Instrumentation and Control Engineering

F559

**Wednesday 18 May 2011
Morning**

Duration: 2 hours

Candidates answer on the question paper.

OCR supplied materials:

None

Other materials required:

- Scientific calculator



Candidate forename		Candidate surname	
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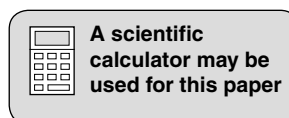
Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions in **Section A** and any **four** questions from **Section B**.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **12** pages. Any blank pages are indicated.



Section A

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

- 1 The block diagram in Fig. 1 shows a thermocouple sensor.

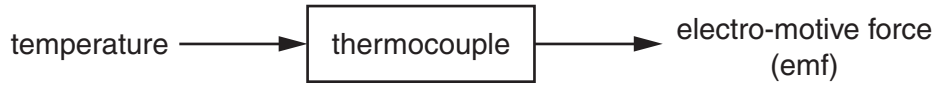


Fig. 1

State which element is the input and which element is the output.

Input

Output [2]

- 2 Draw a labelled block diagram of a closed loop system.

[3]

- 3 Explain what is meant by the term 'signal processor'.

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

- 4 Name **two** passive transducers.

1

2

[2]

5 Explain the operation of a bimetallic strip.

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

6 Give **three** benefits of using simulation software.

1
2
3 [3]

7 A data presentation element has an input which results in a pointer moving across a scale.
Name this type of display.

..... [1]

8 A pneumatic cylinder has a piston of cross-sectional area 0.05m^2 . Calculate the working pressure applied to the cylinder when the force exerted by the piston is 50 kN.

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

[Section A Total: 20]

Section B

Answer any **four** questions in the spaces provided.

1 (a) Give the meaning of the term 'servo control system'.

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

(b) State **three** practical applications that use a servo control system.

1
2
3 [3]

(c) Describe in detail, with the aid of a labelled block diagram, how a direct current motor can be used in a positional control system.

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.....
.....
.....
.....
..... [5]

[Total: 10]

2 (a) Give the meaning of the term 'gain' in an operational amplifier.

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

(b) Give **three** practical applications of an operational amplifier.

1
2
3 [3]

(c) In a positive feedback amplifier the gain is 200. Calculate, correct to one decimal place, the overall gain when the feedback fraction is:

(i) 0.002.

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

(ii) -0.002

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

[Total: 10]

3 Part of an automatic lighting circuit is shown in Fig. 2.

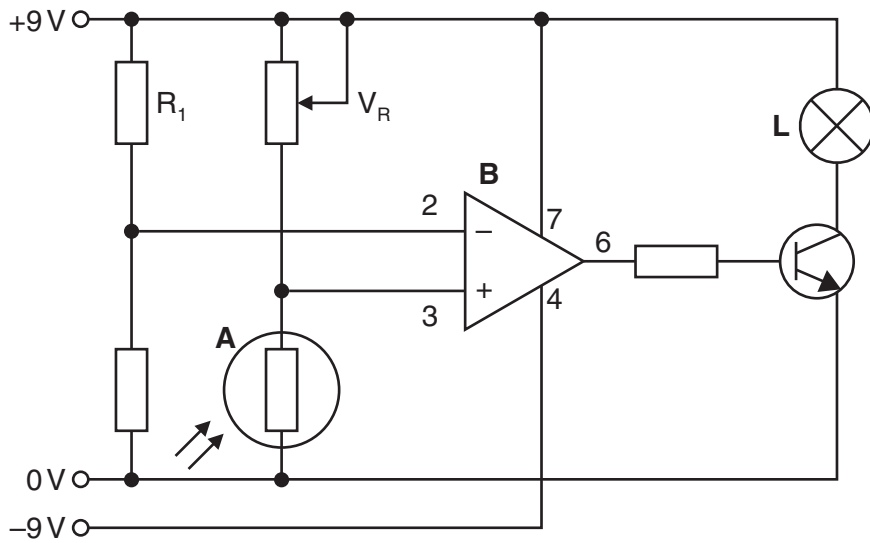


Fig. 2

(a) Name the components labelled A and B in the circuit.

Component A

Component B [2]

(b) State **three** practical applications that use an automatic lighting circuit.

1

2

3 [3]

(c) Explain in detail, the principle of operation of the automatic lighting circuit shown in Fig. 2.

.....

 [5]

[Total: 10]

- 4 Fig. 3(a) shows a pneumatic cylinder being used to clamp work to a machine table. Fig. 3(b) shows a pneumatic cylinder being used to operate a hopper sliding door.

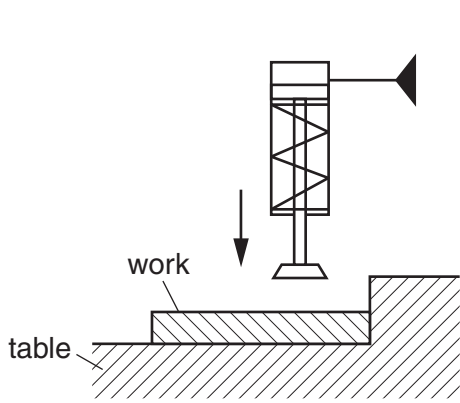


Fig. 3(a)

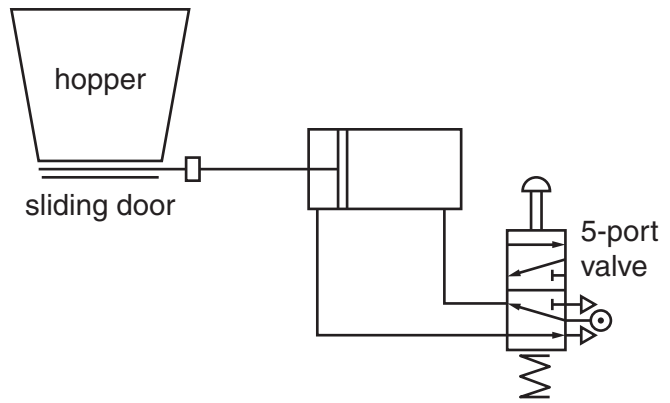


Fig. 3(b)

(a) Name the type of cylinder being used to:

- 1 clamp work to a machine table.

.....

- 2 operate a hopper sliding door.

.....

[2]

(b) Give **three** other practical applications that use the type of cylinder shown in Fig. 3(a).

1

2

3

[3]

(c) Describe in detail, with the aid of a labelled diagram, how **two** 3-port valves can be used to operate a double acting cylinder.

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..... [5]

[Total: 10]

5 (a) Give the meaning of the term 'data signal processing'.

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

(b) Give **three** advantages of using a wave guide as compared to a two conductor type cable.

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

(c) Explain in detail, with the aid of a labelled diagram, the form of wave guide that uses a transverse magnetic mode of signal propagation.

.....
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..... [5]

[Total: 10]

6 (a) Name **two** of the main units used in a programmable logic controller (PLC).

1

2 **[2]**

(b) Give **three** practical applications of a PLC.

1

2

3 **[3]**

(c) Describe in detail, using examples, how PLC controllers have had an impact on instrumentation and control systems.

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..... **[5]**

[Total: 10]

7 (a) State **two** features that you would expect to find on a system that is monitoring a factory production line.

1.....

2 [2]

(b) Explain why it is often necessary to include video cameras in a production line system.

.....

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.....

..... [3]

(c) Describe in detail, with the aid of a labelled block diagram, a monitoring control system used in engineering.

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..... [5]

[Total: 10]

8 (a) Give the meaning of the term 'simulation of electronic circuits'.

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

(b) Give **three** benefits of using simulated circuits.

1

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2

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3

..... [3]

(c) Explain in detail, how a circuit board can be produced in real time using Computer Aided Manufacture (CAM).

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..... [5]

[Total: 10]

[Section B Total: 40]



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