

**Wednesday 11 January 2012 – Morning**

**PRINCIPAL LEARNING LEVEL 3  
ENGINEERING**

**F559/01** Instrumentation and Control Engineering

Candidates answer on the Question Paper.

**OCR supplied materials:**  
None

**Other materials required:**

- Scientific calculator

**Duration: 2 hours**



Candidate forename		Candidate surname	
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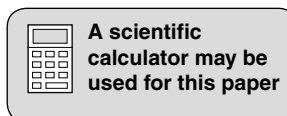
Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions in **Section A** and any **four** questions from **Section B**.
- 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).
- 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 Draw a block diagram of a system showing input, output and control.

[5]

2 Name **two** types of system that use feedback control.

(i) .....

(ii) ..... [2]

3 State the formula for overall gain in a system using negative feedback.

..... [1]

4 State **two** advantages of using a wave guide as compared to a two wire cable.

(i) .....

(ii) ..... [2]

5 Explain what a logic probe is used for.

.....

.....

..... [2]

6 State **two** practical applications that use a pneumatic cylinder as an actuator.

(i) .....

(ii) ..... [2]

7 Name **two** types of display unit.

(i) .....

(ii) .....

[2]

8 Name **two** of the main units used in a Programmable Logic Controller (PLC).

(i) .....

(ii) .....

[2]

9 State which **two** of the following materials are semiconductors.

- Aluminium
- Germanium
- Mica
- Silicon

(i) .....

(ii) .....

[2]

[Section A Total: 20]

Section B

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

1 Part of a temperature operated circuit is shown in Fig. 1.

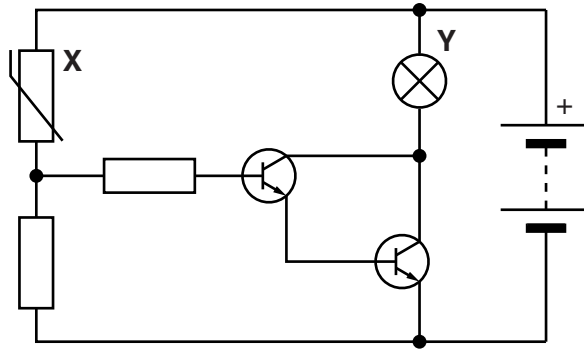


Fig. 1

(a) State **two** practical applications that use a temperature operated circuit in a control system.

1 .....

2 .....

[2]

(b) Name each of the components labelled X and Y in the circuit.

X .....

Y .....

[2]

(c) Describe in detail, the principle of operation of the temperature operated circuit shown in Fig. 1.

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[6]

[Total: 10]

2 (a) State **two** practical applications that use an analogue to digital (A/D) converter.

1 .....

2 .....

[2]

(b) Fig. 2 shows a circuit diagram of an analogue to digital (A/D) converter.

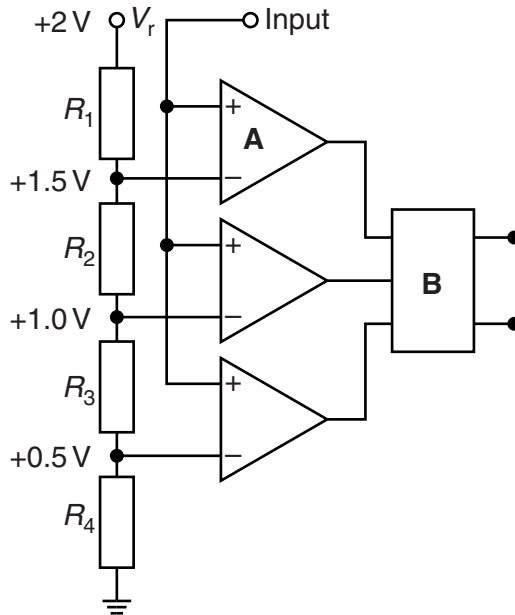


Fig. 2

Name each of the components A and B.

A .....

B .....

[2]

(c) Describe in detail, the principle of operation of the parallel analogue to digital (A/D) converter shown in Fig. 2.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....

[6]

[Total: 10]

Turn over

3 (a) State **two** practical applications that use a wave guide.

1 .....

2 ..... [2]

(b) Name **two** types of transverse mode waveguide propagation.

1 .....

2 ..... [2]

(c) Describe in detail, transverse electric mode waveguide propagation.

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..... [6]

[Total: 10]

4 (a) Draw in the space provided, the graphical symbol for a double acting pneumatic cylinder.

[2]

(b) Give **two** practical applications that use a double acting pneumatic cylinder.

1 .....

.....

2 .....

.....

[2]

(c) Describe in detail, with the aid of a labelled diagram, how **two** double acting pneumatic cylinders can be controlled by a 5-port valve.

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..... [6]

[Total: 10]

5 (a) Explain what is meant by the term 'feedback control'.

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

(b) Give **two** practical applications that make use of feedback in a control system.

1 .....

.....

2 .....

..... [2]

(c) An amplifier with an overall gain of 50 is used in a positive feedback circuit with a feedback fraction of  $1/40$ .  
Calculate, correct to one decimal place, the open loop gain.

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..... [6]

[Total: 10]



6 (a) Explain what is meant by the term input when referring to a control system.

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

(b) Name **one** input device and **one** output device in a control system.

Input device .....

Output device ..... [2]

(c) Describe in detail, with the aid of a block diagram, a closed loop control system that is used in **one** of the following applications:

- domestic white goods
- central heating
- vehicles
- chemical production
- machine tools – computer aided manufacture (CAM)

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.....  
..... [6]

[Total: 10]

7 (a) Explain the term “embedded system” in control engineering.

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

(b) State **two** practical applications that use an embedded system.

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

(c) Describe in detail, an embedded system within a product that you have studied.

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..... [6]

[Total: 10]

8 (a) Give the name and purpose of a simulation software package that you have used.

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

(b) Give **two** benefits of using simulation software packages.

1 .....

.....

2 .....

..... [2]

(c) Describe in detail, with the aid of a labelled diagram, how you used your chosen package to model and test control circuits.

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..... [6]

[Total: 10]

[Section B Total: 40]

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