

OCR

Oxford Cambridge and RSA

Monday 23 May 2016 – Morning

PRINCIPAL LEARNING LEVEL 3 ENGINEERING

F559/01 Instrumentation and Control Engineering

Candidates answer on the Question Paper.

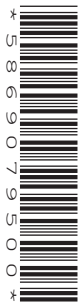
OCR supplied materials:

None

Other materials required:

- Scientific calculator

Duration: 2 hours



Candidate forename		Candidate surname	
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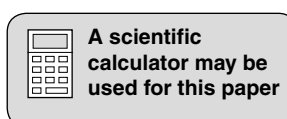
Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- 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 **16** pages. Any blank pages are indicated.



SECTION A

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

1 State **two** characteristics of a closed loop control system.

1

.....

2

.....

[2]

2 Calculate the open loop voltage gain for a system with an input of 100 volts and an output of 10 volts.

.....

..... [2]

3 Draw a diagram to represent an analogue signal and a digital signal.

Analogue Signal

Digital Signal

[2]

4 Fig. 1 shows a circuit diagram using an operational amplifier.

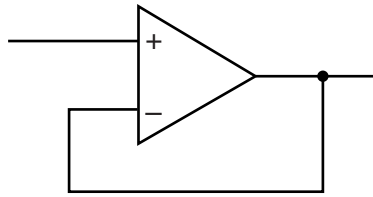


Fig. 1

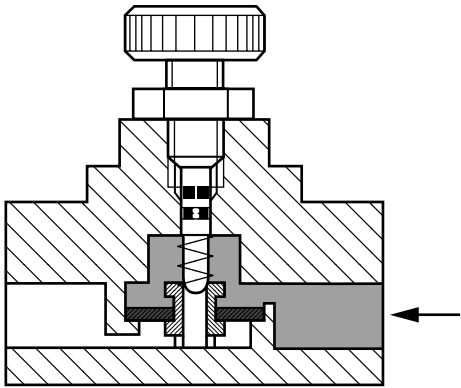
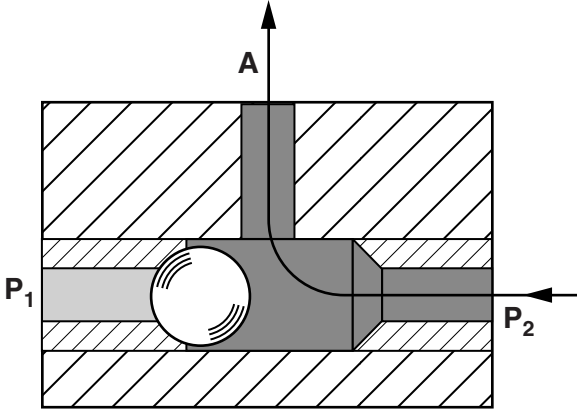
Label the input terminal and state the name given to this type of circuit.

..... [2]

5 Explain what a thermistor is.

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

6 Complete the table by naming each component or by drawing its graphical symbol.

Component cross sectional view	Name of Component or Graphical Symbol
	
	

[2]

7 Name **two** types of level sensors that can provide a feedback signal in a control system.

1

2

[2]

8 Define the term 'reliability' when referring to an embedded system.

.....

.....

..... [2]

9 Explain the purpose of a signal generator.

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

10 Explain why a multiplexer is used.

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

[Total: 20]

SECTION B

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

- 1 (a) Fig. 2 shows a block diagram of a home central heating control system.

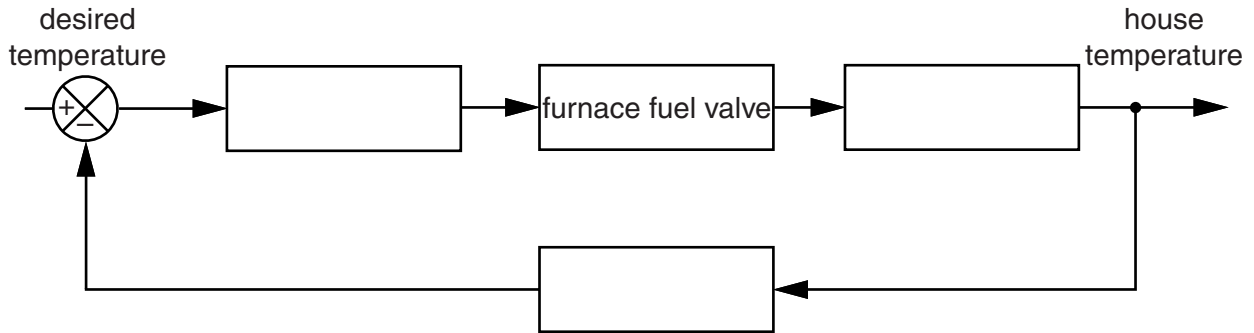


Fig. 2

- (i) Name the type of control system shown in Fig. 2.

..... [1]

- (ii) Label the block diagram with the terms:

- Feedback
- Thermostat Controller
- Home Heating Processor
- Error detector
- Output

[5]

- (b) Draw a labelled block diagram for a measurement system showing the following features:

- Input
- Display
- Signal processor

[4]

[Total: 10]

2 (a) Explain what is meant by the following terms giving **one** example of each:

Open loop control
.....
..... [2]

Closed loop control
.....
..... [2]

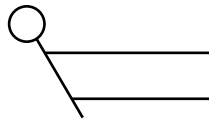
Negative feedback
.....
..... [2]

(b) Name **four** computer input devices.

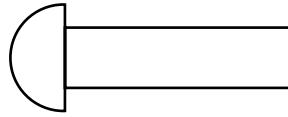
- 1
- 2
- 3
- 4 [4]

[Total: 10]

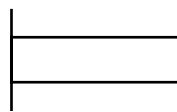
3 (a) Name the manually operated pneumatic components shown below in Fig. 3.



1



2



3

Fig. 3

[3]

(b) Fig. 4 shows a memory function circuit system.

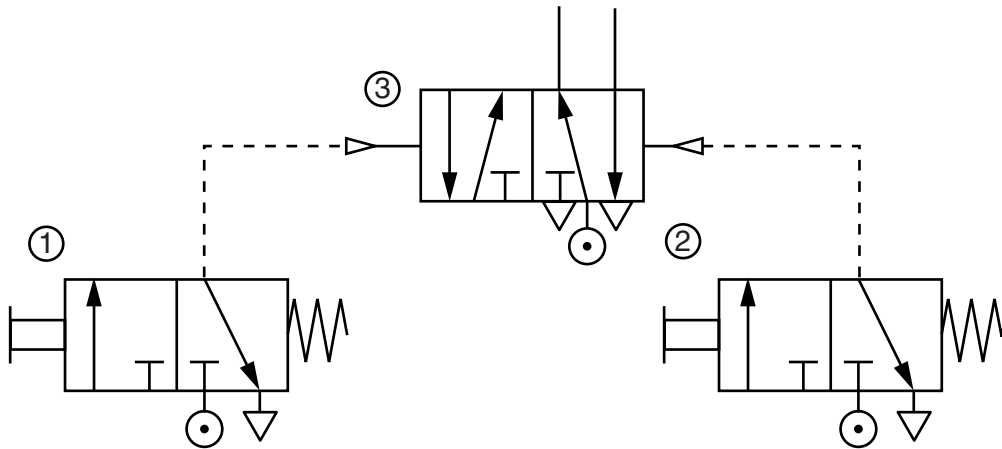


Fig. 4

(i) Name the type of control valve that is being used at position 3 in this system.

..... [1]

(ii) Explain how this circuit works.

.....

.....

.....

.....

.....

.....

.....

..... [6]

[Total: 10]

4 (a) Explain with the aid of a labelled diagram the construction and action of a Bourdon tube.

.....

.....

.....

.....

.....

.....

.....

..... [5]

(b) State why Bourdon tubes are often used in harsh environments.

.....

..... [1]

(c) State **four** effects of over-pressurising a Bourdon tube in a working environment.

1

2

3

4

[4]

[Total: 10]

5 Fig. 5 shows an orifice plate in a pipe.

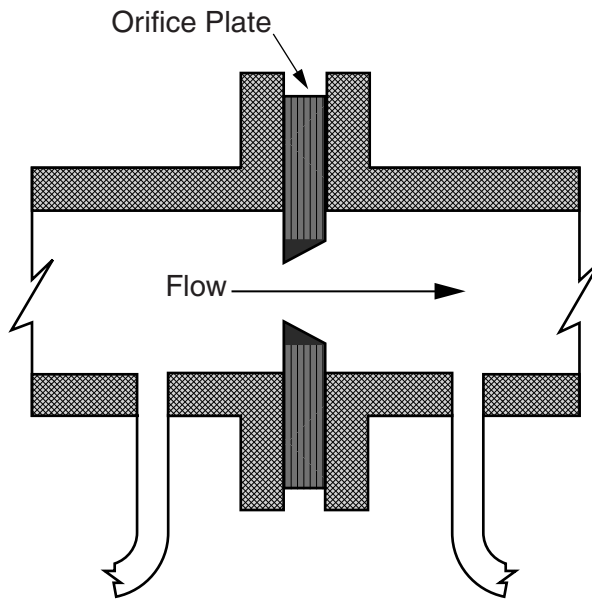


Fig. 5

(a) Explain how an orifice plate is used as a 'Flow Detector' as shown in Fig. 5.

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

(b) State **two** advantages of using an orifice plate as a flow detector.

1
2 [2]

(c) State **two** alternative methods of measuring fluid flow.

1
2 [2]

[Total: 10]

Turn over

6 Fig. 6 shows part of a circuit diagram.

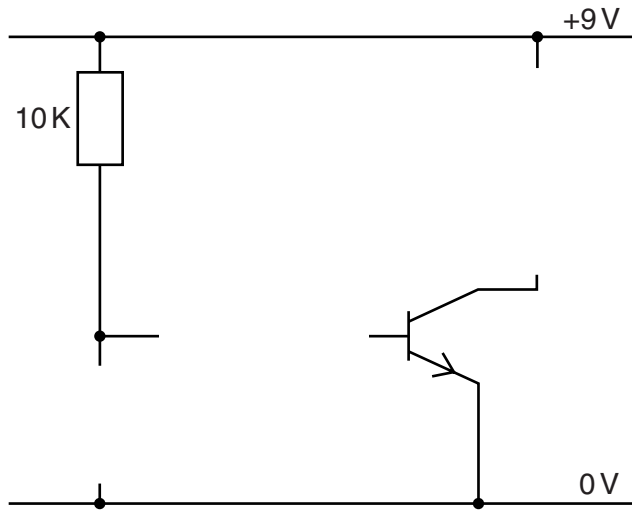


Fig. 6

(a) Name the type of transistor that is being used in the partly completed circuit.

..... [1]

(b) Complete the circuit diagram by adding the following component symbols to Fig. 6.

- a base resistor
- a light-dependent resistor (LDR) as an input device
- a signal lamp as an output device.

[3]

(c) Describe how the completed circuit would work.

.....

 [5]

(d) Name one practical application that uses this type of circuit.

..... [1]

[Total: 10]

7 (a) Explain what is meant by each of the following terms relating to hardware in embedded systems:

Processor

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

Memory

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

User Interface

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

Displays

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

(b) Give **two** benefits of an embedded system over a Programmable Logic Controller (PLC).

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

[Total: 10]

8 Fig. 7 shows a computer package being used to display a circuit diagram as a virtual image.

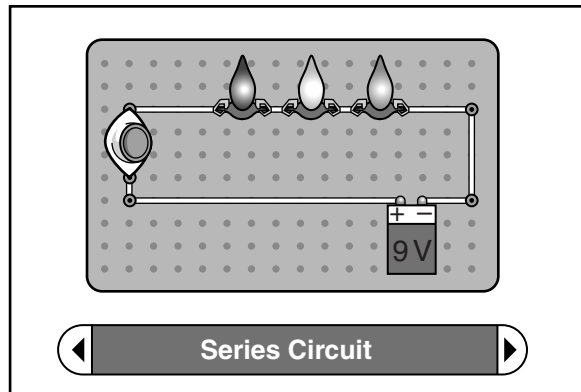


Fig. 7

(a) State **three** benefits of using a simulation software package rather than making the circuit with real components.

- 1
- 2
- 3 [3]

(b) Draw a labelled circuit diagram, using circuit symbols, from the information given in Fig. 7. Also include in the circuit diagram:

- a voltmeter to measure the potential difference of any one signal lamp
- a voltmeter to measure the total potential difference
- an ammeter to measure the total current.

[7]

[Total: 10]

END OF QUESTION PAPER

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