



Wednesday 8 January 2014 – Afternoon

**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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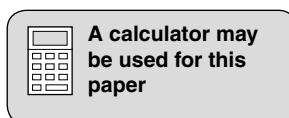
Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- 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 Name **two** input devices and **two** output devices that may be found in a control system.

Input device.

1

2

Output device.

1

2

[4]

2 Explain, using an example, what is meant by the term 'open loop control'.

.....

.....

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

3 State **two** practical applications of a Light Dependant Resistor (LDR).

1

2

[2]

4 Draw the symbol for a 3-port pneumatic valve in the space below.

[2]

5 Name **three** examples of instrumentation displays.

1

2

3

[3]

6 In a positive feedback amplifier the gain is 200.

Calculate the overall gain when the feedback fraction is 1/250.

.....

.....

..... [3]

7 State **two** industrial applications of a Programmable Logic Controller (PLC).

1

2

[2]

8 Explain what is meant by the term 'digital signal' used in a electronic control system.

.....

.....

..... [2]

[Total: 20]

SECTION B

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

1 (a) Explain what is meant by the term 'control' in a control system.

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

(b) Fig. 1 shows the block diagram of a radio receiver control system.

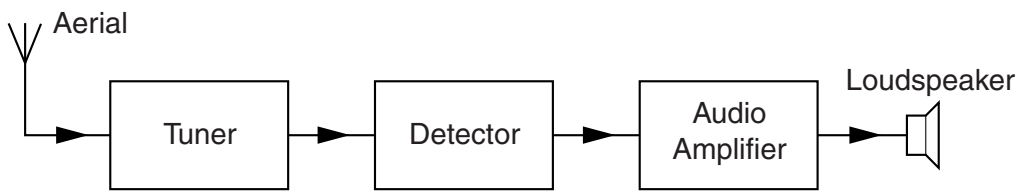


Fig. 1

Explain, in detail, the function of the:

- (i) Tuner
 - (ii) Audio Amplifier
 - (iii) Loudspeaker
- [6]

(c) Give **two** other practical applications for a control system other than a radio receiver.

- 1
 - 2
- [2]

[Total: 10]

2 (a) Explain what is meant by the term 'positive feedback' in a control circuit.

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

(b) Give **two** practical applications of the use of a 'negative feedback' system.

1

2 [2]

(c) Describe in detail, with the aid of a labelled diagram, the operation of a non-inverting operational amplifier.

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

[Total: 10]

3 (a) Explain what is meant by the term 'multiplexer'.

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

(b) Give **two** applications of a multiplexer used in domestic products.

1
2 [2]

(c) Describe in detail, with the aid of a labelled diagram, the operation of a two input digital multiplexer.

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

[Total: 10]

4 (a) State **two** benefits of using light emitting diodes (LEDs) as compared to a signal lamp.

- 1
- 2 [2]

(b) Give **two** practical applications of an LED.

- 1
- 2 [2]

(c) Fig. 2 shows an LED circuit operated by a touch switch.

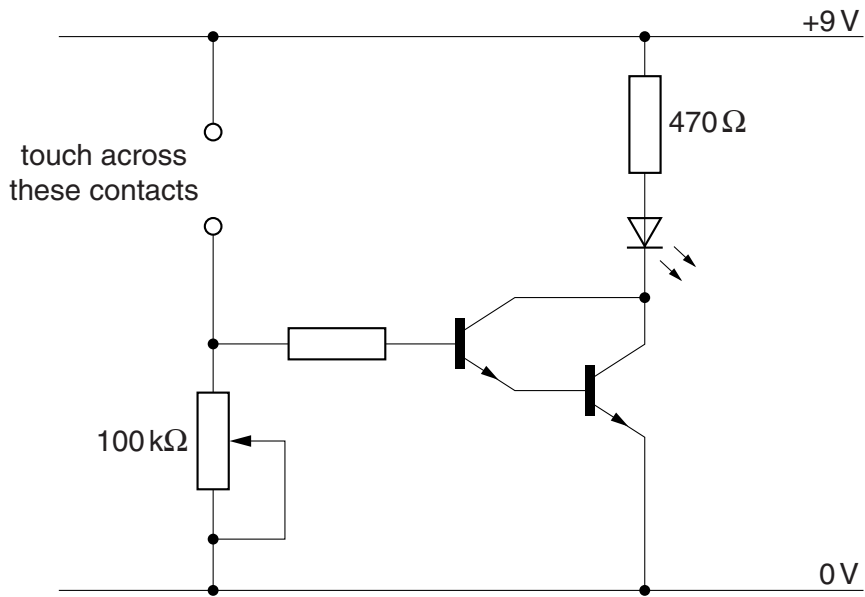


Fig. 2

Describe in detail, how the circuit works.

-
-
-
-
-
-
-
-
-
-
- [6]

[Total: 10]

5 (a) Explain what is meant by the term 'actuator' used in a control system.

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

(b) Give **two** practical applications of an actuator.

1
2 [2]

(c) Describe what is meant by the following types of motion.

Linear Motion

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

Rotary Motion

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

Oscillating Motion

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

[Total: 10]

6 (a) Explain how a 'solenoid valve' operates.

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

(b) Give **two** practical applications of a solenoid valve.

1
2 [2]

(c) Describe, with the aid of labelled diagrams, the construction and action of a single acting pneumatic cylinder and a double acting pneumatic cylinder.

Include a use for each cylinder in your answer.

(i) Single acting pneumatic cylinder

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

(ii) Double acting pneumatic cylinder

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

[Total: 10]

7 (a) Describe how a monitoring control system could deny an intruder access to an engineering workshop.

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

(b) Explain in detail, the function of an embedded control system used in a monitoring system.

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..... [6]

(c) State **two** other applications that use a monitoring system.

1
2 [2]

[Total: 10]

8 (a) Give **two** reasons for using simulation software to construct a circuit.

1

2 [2]

(b) Fig. 3 shows a virtual signal generator.

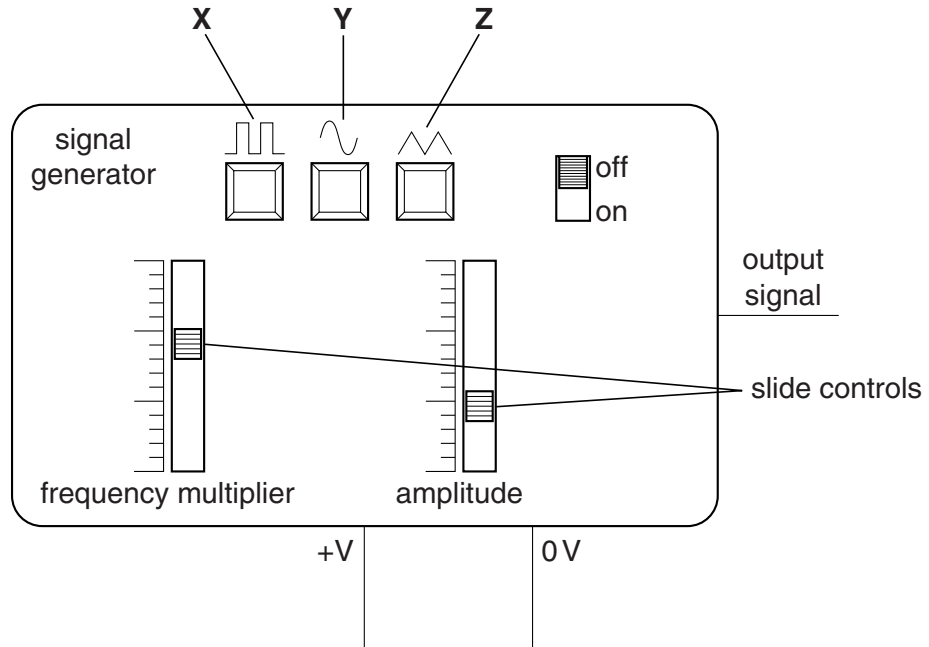


Fig. 3

Give **two** reasons for using a virtual signal generator to test a simulated circuit.

.....
 [2]

(c) (i) On Fig. 3 **X**, **Y** and **Z** are wave forms. Wave form **X** is a square wave.

Name the wave forms **Y** and **Z**.

Wave form **Y**

Wave form **Z** [2]

- (ii) Describe, with the aid of a diagram, what happens to the output signal when the frequency multiplier slide control is adjusted.

.....

.....

..... [2]

- (iii) Describe, with the aid of a diagram, what happens to the output signal when the amplitude slide control is adjusted.

.....

.....

..... [2]

[Total: 10]

END OF QUESTION PAPER



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