



Rewarding Learning

**General Certificate of Secondary Education
2024**

Technology and Design

Unit 2

Option A: Electronic and Microelectronic
Control Systems

[GTY21]

WEDNESDAY 12 JUNE, MORNING

**MARK
SCHEME**

General Marking Instructions

Introduction

Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses. The mark schemes should be read in conjunction with these general marking instructions..

Assessment objectives

Below are the assessment objectives for GCSE Technology and Design.

Candidates must:

- AO1** Recall, select and communicate their knowledge and understanding of Technology and Design in a range of contexts;
- AO2** Apply skills knowledge and understanding, including quality standards in a variety of design contexts. Plan and carry out investigations and making tasks involving an appropriate range of tools, equipment, materials and processes; and
- AO3** Analyse and evaluate evidence, design proposals and outcomes, make reasoned judgements and present conclusions and recommendations.

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of an unanticipated answer, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive Marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate..

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response

Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for the 'best fit' bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement. The following guidance is provided to assist examiners.

Level 1: Response which merits inclusion in the band and should be awarded the lower mark.
Level 2: Response which merits inclusion in the band and should be awarded the higher mark.

Marking calculations

In marking answers involving calculations, examiners should apply the “own figure rule” so that candidates are not penalised more than once for a computational error.

Quality of written communication

Quality of written communication is taken into account in assessing candidates’ responses to all tasks and questions that require them to respond in written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

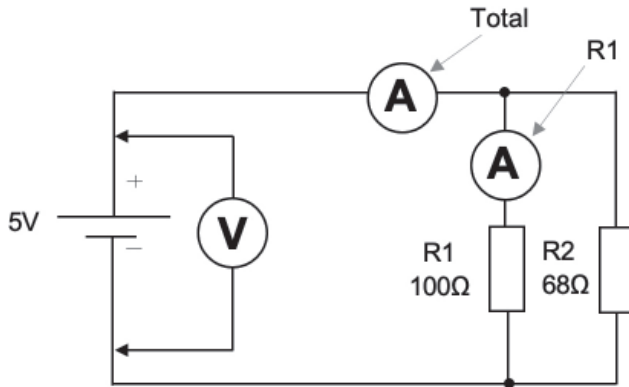
For conciseness, quality of written communication is distinguished within levels of response as follows:

- Band 1: Quality of written communication is basic.
- Band 2: Quality of written communication is limited.
- Band 3: Quality of written communication is satisfactory.
- Band 4: Quality of written communication is good.
- Band 5: Quality of written communication is excellent.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided in the relevant question in the mark scheme.

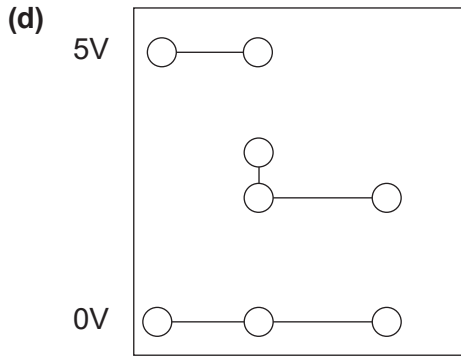
- 1 (a) (i) Parallel [1]
- (ii) $I = 5/68$ [1]
 $= 0.074$ [1] Amps [1] [3]
- (iii) $R_{total} = (100 \times 68)/(100 + 68)$ [1]
 $= 40.48$ [1] ohms [1] [3]

(b) (i) and (ii)



Source: CCEA

- (i) Correct voltmeter symbol [1]
 Appropriate connections [1]
- (ii) Correct ammeter symbol [1]
 Appropriate connections to measure current flowing through R1 [1]
 Appropriate connections to measure the total current flowing through the circuit [1]
- All relevant, valid responses will be given credit** [5]
- (c) (i) R3 – variable resistor [1]
 R4 – thermistor [1] [2]
- (ii) moving [1]
 the wiper [1]
 increasing [1]
 the temperature around the component [1]
- All relevant, valid responses will be given credit** [4]
- (iii) $V_{out} = 5 \times 3/(5 + 3)$ [1]
 $5 \times 3/8$ [1]
 5×0.375 [1]
 1.88 [1] [4]
- (iv) The voltage V_{out} can have a wide variation [1] depending on the adjustment of R3 or the temperature of R4 [1]
- All relevant, valid responses will be given credit** [2]



Pads for each component as shown ($3 \times [1]$)
 Tracks for each component as shown ($3 \times [1]$)

[6]

(e) (i) To discharge [1] the capacitor [1]

All relevant, valid responses will be given credit

[2]

(ii) Continuously [1] alternates between two states [1]

All relevant, valid responses will be given credit

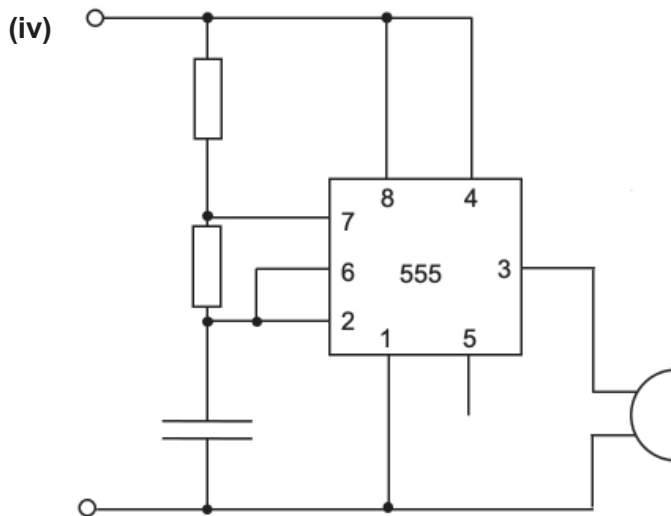
[2]

(iii) Maximum output voltage = 6 V [1]

The time period = 0.5 s [1]

The frequency = 2 Hz [1]

[3]



Source: CCEA

Each correct lead as shown
 ($3 \times [1]$)

[3]

(f) **Indicative content** – candidate responses may include references to the following:

- They use very little energy: e.g. environmental, reduces cost, longer battery life for portable appliances, brighter
- They are very long lasting: e.g. require less maintenance, improved reliability, good for awkward locations, reduces cost, more robust
- They are available in a wide range of colours, e.g. colour can be changed to suit product application, may control colour spectrum emission
- They are safer: e.g. reduce burns, less fire risk, no glass to break, lower voltage operation so less risk of electrocution, weather-proof
- They may be switched quickly: e.g. digital communication, signalling, fibre optics, TV remotes
- They are available in a wide range of formats and sizes, may be incorporated into miniature product sizes, enables designers to develop miniature products, may be embedded in products.

A disadvantage of using an LED instead of a bulb:

- Generally requires a current limiting resistor
- Polarity is important
- May not directly operate from an ac supply
- Compared to bulbs, generally difficult to change or replace

A suitable application for a 7-segment display would be:

- A scoring device – it can display numbers and a range of letters
- A digital clock – it can display the numbers required on a clock
- A speedometer – can display numbers
- A digital timer – can be used to display times in sporting activities

All relevant, valid responses will be given credit

Response Band	Description	Mark
When a response is not worthy of credit, a [0] mark should be awarded		
Basic [1]–[2]	Candidate response misses the focus of the question. This response may or may not be well written.	1
	Candidate answers contain little content, of very limited accuracy and their explanations are very limited. The response lacks clarity and coherence and is poorly organised. The level of written communication is basic.	2

AVAILABLE MARKS

Limited [3]–[4]	Candidate answers are not complete, of limited accuracy and their explanations are very limited. The level of written communication is limited but conveys some information. It is very limited in technical vocabulary and specialist terms. Spelling, punctuation and grammar lack accuracy.	3
	Candidate answers are not complete, of limited accuracy, and their explanations are limited. The level of written communication is limited but conveys some information. It is limited in technical vocabulary and specialist terms. Spelling, punctuation and grammar lack accuracy.	4
Satisfactory [5]–[6]	Candidate answers are almost complete, fairly accurate and their explanations are fairly satisfactory. The level of written communication is satisfactory and conveys some technical vocabulary and specialist terms. The accuracy of spelling, punctuation and grammar is satisfactory.	5
	Candidate answers are almost complete and generally accurate, and their explanations are satisfactory. The level of written communication is satisfactory and conveys some technical vocabulary and specialist terms. The accuracy of spelling, punctuation and grammar is satisfactory.	6
Good [7]–[8]	Candidate answers are almost complete, generally accurate, and their explanations are generally good. The level of written communication and technical vocabulary and specialist terms is generally good. The accuracy of spelling, punctuation and grammar is good.	7
	Candidate answers are almost complete, mostly accurate and their explanations are of a very good standard. The level of written communication and technical vocabulary and specialist terms is very good. The accuracy of spelling, punctuation and grammar is very good.	8
Excellent [9]–[10]	Candidate answers are almost complete, mostly accurate and their explanations are of an excellent standard. The level of written communication and technical vocabulary and specialist terms is mostly excellent. The accuracy of spelling, punctuation and grammar is mostly excellent.	9
	Candidate answers are complete, fully accurate and their explanations are of an excellent standard. The level of written communication and technical vocabulary and specialist terms is excellent. The accuracy of spelling, punctuation and grammar is excellent.	10

(10 × [1])

[10]

**AVAILABLE
MARKS**

50

2 (a) (i) Single pole double throw or SPDT [1]

(ii) A magnet [1] will cause the contacts to close. [1]

All relevant, valid responses will be given credit [2]

(iii) Switch C [1]
Once operated it stays in position [1] unless reset manually. [1]

All relevant, valid responses will be given credit [3]

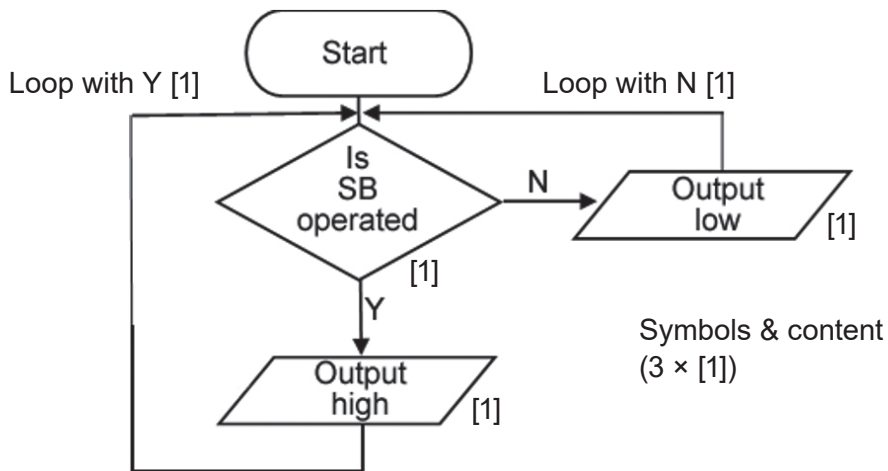
(b) (i) Any **two** from:
Microcontroller (PICs) are versatile. [1] A range of input and output devices can be connected at the same time. [1]
Reprogrammable [1] Allows changes to be made to programs without changing actual components. [1]
Reduction in size/complexity [1] of the circuit. The internal components and programming replace many physical components. [1]
(2 × [2])

All relevant, valid responses will be given credit [4]

(ii) All input to the PIC [1] is connected to the 5 volt rail. [1]

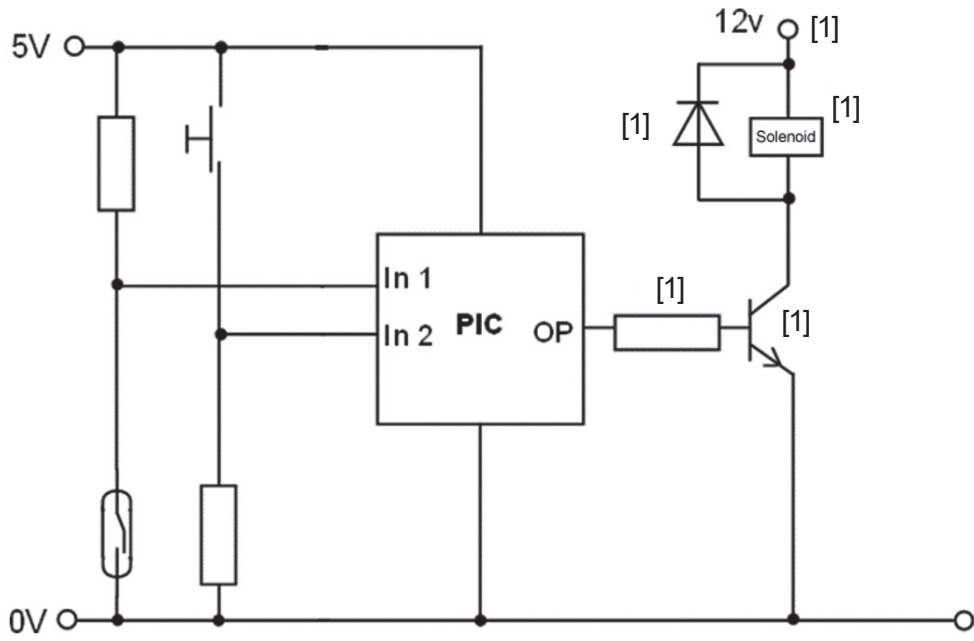
All relevant, valid responses will be given credit [3]

(iii)



All relevant, valid responses will be given credit [5]

(iv)

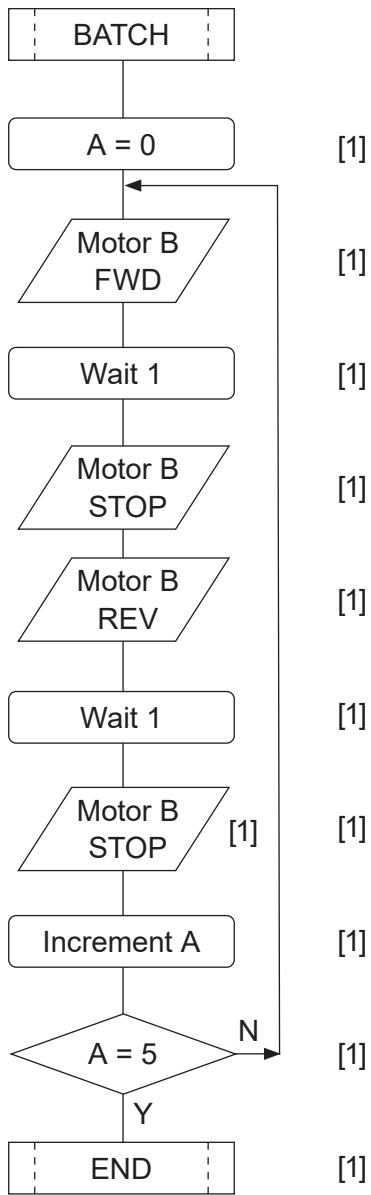


All relevant, valid responses will be given credit

[5]

AVAILABLE
MARKS

(c) (i)

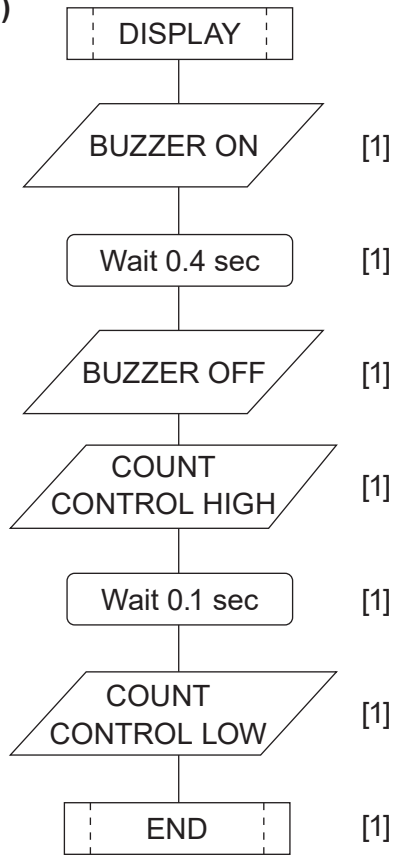


All relevant, valid responses will be given credit

[11]

AVAILABLE MARKS

(ii)

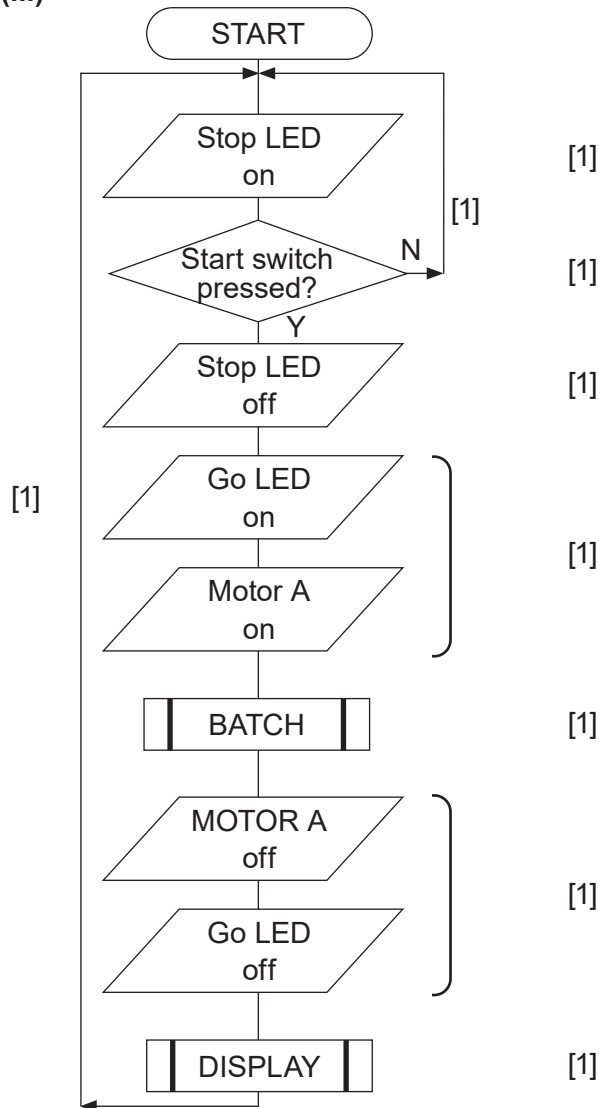


All relevant, valid responses will be given credit

[7]

AVAILABLE MARKS

(iii)



All relevant, valid responses will be given credit

[9]

Total

AVAILABLE MARKS

50

100