Cambridge National

Engineering

R113/01: Systems Control in Engineering: Electronic principles

Level 1/2 Cambridge National Certificate/Award

Mark Scheme for June 2022

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

    YOU MUST MARK 5 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
    Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions
Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses
When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
    - there is nothing written in the answer space. Use **'seen'** to indicate that the NR has been checked.

    Award Zero '0' if:
    - anything is written in the answer space and is not worthy of credit (this includes text and symbols). Use **'seen'** to indicate that the zero has been checked.

    Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
    If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

10. For answers marked by levels of response: Not applicable in F501
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following

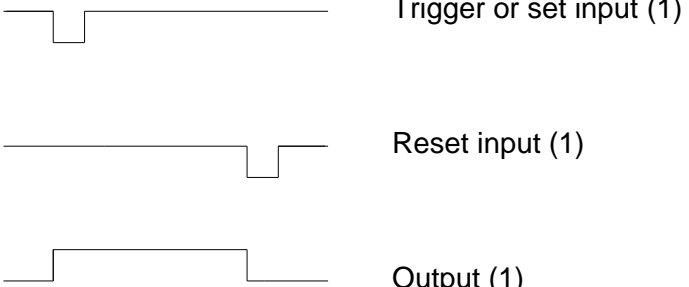| Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level

Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	Meaning
BP	Blank page
VG	Vague
✔	Tick
SEEN	Noted but no credit given
REP	Repeat
K	Knowledge
EG	Example/Reference
DEV	Development
BOD	Benefit of doubt
?	Unclear
L3	Level 3
L2	Level 2
L1	Level 1

Question			Answer	Mark	Guidance
1	(a)			2	Award one mark for each correct symbol i.e. variable resistor and light dependent resistor (LDR).
	(b)		Fuse (1) Capacitor (1) Diode (1)	3	Accept Ceramic Capacitor
	(c)			2	Award one mark for each correct switch position.
	(d)			3	
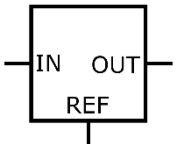
Question			Answer	Mark	Guidance
			Resistors are rated by the value of their resistance (1) and electrical power. (1) The power rating of a resistor is the term given to a resistor describes the maximum amount of power that the resistor can withstand. (1)		
			Total	**10**	

Question			Answer	Mark	Guidance
2	(a)		NOT (1) NOR (1) XOR (1) AND (1)	**4**	
	(b)		Trigger or set input (1) Reset input (1) Output (1)	**3**	
	(c)		$T = 1.1RC$ $= 1.1 \times 50 \times 10^3 \times 10 \times 10^{-6}$ $= 0.55$ s	**3**	Award one mark for 50×10^3. Award one mark for 10×10^{-6}. Award one mark for 0.55 or 0.55 s. Award full marks for correct answer with no working i.e. 0.55 or 0.55 s.
			Total	**10**	

Question			Answer	Mark	Guidance
3	(a)		- Switch on the multimeter. - Set the dial to the appropriate resistance mode. - Touch the two test probes of the multimeter together. - The multimeter should register zero ohms of resistance. - Touch each end of the resistor with the test probe. - If the resistor is faulty the multimeter will register zero. - If the resistor is in working order the multimeter will register its value. - Set the resistor dial to give you the most accurate reading.	4	Award one mark for each correct response up to maximum of four marks
	(b)		A residual current device permanently monitors the wiring installation.(1) The aim is to detect any leaking current (1) by continuously measuring the amount of current passing through a wire in one direction (1), and again through a different wire in the opposite direction. (1).	4	.
	(c)		Cable A is a multi-core. (1) Cable B is a ribbon cable. (1)	2	
			Total	**10**	

Question			Marks	Mark	Answer
4	(a)	(i)	Automatic optical inspection is used on large batches of printed circuit boards. • The automatic optical inspection machine uses a series of high-powered cameras to look at the printed circuit board. • The cameras are placed at different angles to inspect the soldered connections. • Each solder connection will reflect light in a different manner. • This allows the camera to pick out a lower-quality solder connection. • The inspection is carried out at a very high speed, allowing it to process a high quantity of PCBs in a relatively short time.	4	Award one mark for each correct response, up to a maximum of four marks.
		(ii)	Faults: • Poor soldering • Incorrect components • Loose components • Components connected wrong way round • Missing components • Broken tracks • Broken leads • Short circuits • Open circuits	2	Award one mark for each correct fault up to a maximum of two marks.
	(b)			4	Award one mark for each correct label.
			Total	10	

Question			Marks	Mark	Answer	
Question			Answer	Mark	Guidance	
5	(a)		$I = V/R$ (1) $= 230/46$ (1) $= 5$ (1)A (1)	4	Award four marks for correct answer 5 or 5 A without any workings. Other variations of Ohms Law accepted	
	(b)		$P = I^2R$ (1) $= 4^2 \times 0.75$ (1) $= 12$ (1) W (1)	4	Award four marks for correct answer 12 or 12 W without any workings.	
	(c)		henry (1) farad (1)	2	Accept multiple and submultiple units	
				Total	10		

Question	Answer	Mark	Guidance

6 (a)*	**Level 3 (5–6 marks)**
	• Detailed discussion showing a thorough understanding of the function and applications of a voltage regulator in electronic circuits.
	• Information is presented clearly and accurately, with correct use of appropriate technical language and engineering terminology.
	• Accurate use of spelling, punctuation and grammar.
	
	Level 2 (3–4 marks)
	• Adequate discussion showing some understanding of the function and applications of a voltage regulator in electronic circuits.
	• Information is presented clearly and with some accuracy with appropriate technical language and engineering terminology used on some occasions.
	• Occasional errors in spelling, punctuation and grammar.
	
	Level 1 (1–2 mark)
	• Basic discussion showing limited understanding of the function and applications of a voltage regulator in electronic circuits.
	• Information presented is basic and may be ambiguous or badly presented, with little or no use of technical language and engineering terminology.
	• Errors of spelling, punctuation and grammar may be intrusive.
	
	Level 0 (0 marks)
	• A response that is irrelevant and/or not worthy of a mark.
	• Annotate with 'seen' at end of response.
		6	**Function and applications**
			
			A voltage regulator is a device that provides a constant DC output voltage.
			The input voltage can come from a battery or an AC rectifier device.
			Voltage regulators have two categories:
			   (a) Linear regulator
			   (b) Switching regulator.
			The linear regulator can be either a series or shunt regulator.
			The switching regulator is either step-down, step-up or inverting.
			Integrated Circuit (IC) voltage regulators usually have three terminals that provide a positive or negative output.
			
			Accept comments linked to IN, OUT, REF:
			
			Applications.
			Mobile Phones – stable 5 V DC output.
			Computer power supply.
			Bench power supplies.
			Regulated power supplies in appliances.
			Car alternators.
			Electricity substations.
			
			Accept any other correct responses.

Question				Answer	Mark	Guidance
	(b)				**4**	Accept I = Input O = Output
				Total	**10**	

Table within answer for (b):

Component	Type of device
Light Emitting Diode (LED)	Output (1)
NTC Thermistor	Input (1)
Photodiode	Input (1)
Relay	Output (1)

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on

01223 553998

Alternatively, you can email us on

support@ocr.org.uk

For more information visit

ocr.org.uk/qualifications/resource-finder

ocr.org.uk

Twitter/ocrexams

/ocrexams

/company/ocr

/ocrexams