



Cambridge National

Engineering

Unit **R113**: Electronic principles

Level 1/2 Cambridge National Award/Certificate in Systems Control in Engineering

Mark Scheme for June 2015

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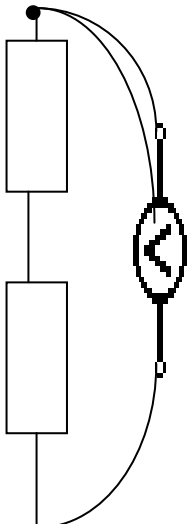
This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

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Question			Answer	Mark	Guidance
1	(a)	(i)	Series	1	
		(ii)	$R_T = 12 + 8$ $= 20\Omega$	1 1	Award two marks for 20Ω without workings. Award one mark for 20 without workings.
		(iii)	$I = V/R_T$ $= 10/20$ $= 0.5A$	1 1	Award two marks for 0.5A without workings. Award one mark for 0.5 without workings.
		(iv)	$V = IR_8$ $= 0.5 \times 8$ $= 4V$	1 1	Award two marks for 4V without workings. Award one mark for 4 without workings.
1	(b)	(i)		1	Allow one mark for an alternative clear written description.
		(ii)	Resistor colours: Brown, Red, Black Maximum value is 12.6 Ω	1 1	Award one mark for 12.6.

Question			Answer	Mark	Guidance
2	(a)	(i)	LDR – Light Dependent Resistor.	1	
		(ii)	To turn the circuit on when the light level drops. In darkness the resistance of the LDR is high.	1	Award mark for understanding shown.
		(iii)	LED – Light Emitting Diode.	1	
		(iv)	The transistor TR1 acts as an amplifier.	1	Award mark for understanding shown.
		(v)	$I = (9 - 1)/500$ $= 8/500$ $= 0.016A$	1 1 1	Award three marks for correct answer with or without working. Award two marks for 0.016 with or without working.
2	(b)		<p>Examples of LED applications are:</p> <p>Indicates whether equipment is on or off</p> <p>General alphanumeric displays - in seven-segment, starburst and dot-matrix format.</p> <p>Digital voltmeter – reading is in the form of digits</p> <p>Lighting in all its forms – indoor, outdoor</p> <p>Low level bicycle signal lighting.</p> <p>Light detector</p> <p>Television sets</p>	3	<p>Award one mark for each correct application.</p> <p>Accept any correct application.</p>

Question		Answer	Mark	Guidance
4	(a)	<p>To measure current we need:</p> <ol style="list-style-type: none"> 1 Move lead V to A 2 Rotate switch knob from V to A 3 Remove the connection from one side of the motor 4 Connect the multi-meter in series 	<p>1 1 1 1</p>	
	(b)	<p>Level 3 (5–6 marks)</p> <ul style="list-style-type: none"> • Detailed discussion showing a thorough understanding of the process carried out in a portable appliance test (PAT). • Detailed discussion showing a thorough understanding of the benefits of PAT testing for the consumer • Information is presented clearly and accurately, with correct use of appropriate technical language and engineering terminology. • Accurate use of spelling, punctuation and grammar. <p>Level 2 (3–4 marks)</p> <ul style="list-style-type: none"> • Adequate discussion showing some understanding of the process carried out in a portable appliance test (PAT). • Adequate discussion showing some understanding of the benefits of PAT testing for the consumer • Information is presented clearly and with some accuracy. Appropriate technical language and engineering terminology is used on some occasions. • Occasional errors in spelling, punctuation and grammar. <p>Level 1 (1–2 marks)</p> <ul style="list-style-type: none"> • Basic discussion showing limited understanding of the process carried out in a portable appliance test (PAT). • Basic discussion showing some limited understanding of the benefits of PAT testing for the consumer • Information presented is basic and may be ambiguous or badly presented. • There will be little or no use of technical language and engineering terminology. • Errors of spelling, punctuation and grammar may be intrusive. <p>Level 0 (0 marks)</p> <ul style="list-style-type: none"> • A response that is irrelevant and/or not worthy of a mark. Annotate with ‘Seen’ at end of response. 	<p>6</p>	<p>Portable Appliance Test (PAT testing) includes:</p> <ol style="list-style-type: none"> 1: Preliminary inspection 2: Functional checks 3: Earth continuity 4: Insulation checks. <p>In the UK, there is no requirement to have a formal qualification for persons carrying out PAT Testing. The Electricity at Work regulations of 1989 simply state that inspecting and testing must be carried out by a competent person.</p> <p>Benefits of PAT testing to include: Assurance that appliance has been tested regularly Less chance of electric shock from faulty appliance Visual confirmation that a test has taken place Written details of when test took place.</p>

Question		Answer	Mark	Guidance
5	(a)	<p>1 Place clean components in position on PCB.</p> <p>2 Tin the soldering iron having checked that the tip size matches the parts being soldered.</p> <p>3 Apply solder to the component joints.</p> <p>4 Check that before turning the circuit board over that all components are securely fixed and then Inspect each joint and carry out remedial work if necessary.</p>	4	Award marks for understanding shown.
	(b)	<p>A PCB eraser is used to remove any film from the tracks.</p> <p>The film will prevent good soldering of the components to the PCB.</p>	1 1	Be aware of the term “abrasive eraser”.
	(c)	<p>Any visual inspection.</p> <p>Any automatic test e.g. Continuity test, Automated Optical Inspection (AOI).</p>	1 1	
	(d)	<p>Examples of precautions are:</p> <p>Wear goggles.</p> <p>Wear gloves</p> <p>Use a fume extractor</p> <p>Only work in an environment that is well lit and ventilated</p> <p>Never leave the soldering iron plugged in and unattended</p> <p>Never set your hot iron down on anything other than an iron stand</p> <p>Use needle nose pliers</p> <p>Be careful to keep clothes, hair, skin and power cables away from the soldering iron tip and the metal shaft.</p> <p>Always handle the iron by the plastic handle.</p>	2	Award one mark for each correct precaution.

Question			Answer	Mark	Guidance															
6	(a)	(i)	AND gate	1																
		(ii)	Input A or B Output C Input B or A	1	Award one mark for three correct positions.															
		(iii)	<table border="1"> <thead> <tr> <th>Input A</th> <th>Input B</th> <th>Output C</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	Input A	Input B	Output C	0	0	0	0	1	0	1	0	0	1	1	1	1	Award one mark for correct column output C.
Input A	Input B	Output C																		
0	0	0																		
0	1	0																		
1	0	0																		
1	1	1																		

Question		Answer	Mark	Guidance																									
(b)	(i)	<table border="1"> <thead> <tr> <th>Input A</th> <th>Input B</th> <th>Input C</th> <th>Input D</th> <th>Output E</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	Input A	Input B	Input C	Input D	Output E	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	1	1	0	1	1	3	Award one mark for each correct column input C, input D and output E.
		Input A	Input B	Input C	Input D	Output E																							
		0	0	1	0	1																							
		0	1	0	0	0																							
		1	0	0	0	0																							
1	1	0	1	1																									
(c)	(i)	A bistable circuit has two stable states and/or needs an input to change from one state to another.	1																										
	(ii)	The logic level is unpredictable.	1																										
	(iii)	High/1	1																										
	(iv)	High/1	1																										

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

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