OCR
Oxford Cambridge and RSA

Cambridge National

Systems Control in Engineering

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

R113/01 Electronic principles

Mark Scheme for Jan 2020

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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.

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

Question			Answer	Mark	Guidance
1	(a)		Polarised signal push to make light dependent	4	Award one mark for each correct component.
	(b)		R = V/I = 12/0.5 = 24 Ω	3	Award one mark for R = V/I. Award one mark for 12/0.5. Award one mark for 24 Ω or 24. Award three marks for a calculation when there is no working but the numerical answer is correct.
	(c)		W = Pt = 900 x (10/60) = 150 Wh = 0.15 kWh	3	Award one mark for W = Pt. Award one mark for 900 x (10/60) or 150 Wh Award one mark for 0.15 kWh or 0.15. Award three marks for a calculation when there is no working but the numerical answer is correct.
	(d)		electrolytic tantalum	2	Award one mark for each correct response.
			Total	12	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><th>Component</th><th>Type of Device</th></tr>
<tr><td>Relay</td><td>Output</td></tr>
<tr><td>Microphone</td><td>Output</td></tr>
<tr><td>Phototransistor</td><td>Input</td></tr>
<tr><td>Pressure switch</td><td>Input</td></tr>
<tr><td>Light Emitting Diode</td><td>Output</td></tr>
<tr><td>Touch screen</td><td>Input</td></tr>
</table>
</td><td>6</td><td>Award one mark for each correct type of device.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Brown indicates 1

Grey indicates 8

Red indicates 2 zero’s

Gold indicates 0.05 or 5%

The resistor value is 1800 Ω ± 5% or 1.8 kΩ ± 5%
or 1K8 ± 5%</td><td>3</td><td>Award one mark for 1800.
Award one mark for 0.05 or 5% or ± 5%.
Award one mark for 1800 Ω ± 5% or 1.8 kΩ ± 5%
or 1K8 ± 5%.

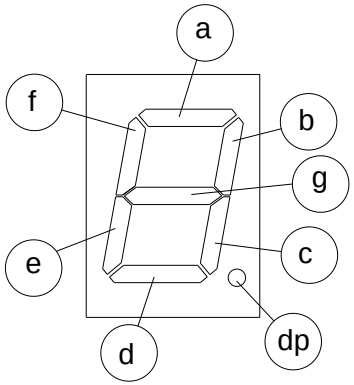
Award three marks when there is no working but the numerical answer is correct.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Different power ratings are available because different resistors give out different amounts of heat for an indefinite time without degrading the performance of the resistor</td><td>1</td><td>Award one mark for an understanding of power rating of a resistor considering ‘heat’ and ‘current’.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td></tr>
</table>

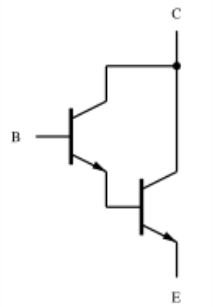
Question			Answer	Mark	Guidance
3	(a)		Equipment that is used to test electronic circuits: Ammeter. Voltmeter. Ohm meter. Power supply unit. Logic probe. Signal generator. Oscilloscope.	4	Award one mark for each correct item of equipment up to maximum of four marks.
3	(b)	(i)	Multimeter to test for continuity in a fuse: Connect black lead to the common socket. Connect and red lead to the Ω socket. Move the dial to the lowest range on the resistance scale. Switch on / check that the multimeter is working. Touch the metal caps at each end of the fuse with the metal tip of the leads. If the meter reading does not change the fuse is blown.	4	Award one mark for each correct point made up to a maximum of four marks. Allow reference to a continuity reading /scale.
3	(b)	(ii)	Specific uses of a multimeter are: Checking voltage. Measuring resistance value. Measuring current flow. Finding transistor gain. Finding the value of a capacitor. Fault finding on a printed circuit board. Checking continuity.	2	Award one mark for each correct use up to maximum of two marks.
			Total	10	

<table>
<tr><th colspan="3">Question</th><th>Marks</th><th>Mark</th><th>Answer</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>
<table>
<tr><th>Statement</th><th></th></tr>
<tr><td>Fewer holes need to be drilled onto the circuit board.</td><td>Benefit</td></tr>
<tr><td>Large, high-power or high-voltage parts are unsuitable for surface mount construction.</td><td>Drawback</td></tr>
<tr><td>Manual prototype or component level repair is more difficult.</td><td>Drawback</td></tr>
<tr><td>Skilled operators are needed with expensive tools as the parts are much smaller.</td><td>Drawback</td></tr>
<tr><td>Components can be placed on either side of the circuit boards.</td><td>Benefit</td></tr>
<tr><td>Better mechanical performance under shake
and vibration conditions.</td><td>Benefit</td></tr>
</table>
</td><td>6</td><td>Award one mark for each correct response up to a maximum of six Marks.</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Visual inspection considerations:

Quality of soldered joints.
Discolouring of solder and or components.
Security of components/connections - loose or dry joints.
Component values correct.
Components placed in correct position.
Components connected the right way round.</td><td>4</td><td>Award one mark for each correct point made up to a maximum of four.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
5	(a)*		**Level 3 (5–6 marks)** • Detailed discussion showing a thorough understanding of the function and applications of an LCD 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 an LCD 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 an LCD 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**	The **Liquid crystal display LCD i**s an electronic display device that operates by applying a varying electric voltage to a layer of liquid crystal, thereby inducing changes in its optical properties. Liquid crystals represent a phase in between liquid and solid. The molecules can move independently, as in a liquid, but remain organized, as in a crystal. Liquid crystal sheets are thermotropic, which means that they respond to changes in temperature by changing colour. LCDs are commonly used for: Various types of monitor Instrument panels Digital clocks Portable electronic games Viewfinders for digital cameras or camcorders Video projection systems Electronic billboard Flat-panel televisions Calculators Watches Accept any other correct applications.

Question			Answer	Mark	Guidance
	(b)			4	Award one mark for each two correct letters
			Total	**10**	

Question			Answer	Mark	Guidance
6	(a)	(i)	NPN transistor	2	Award one mark for NPN. Award one mark for transistor. Award two marks for NPN transistor.
	(a)	(ii)	Transistor array Array	2	Award two marks for transistor array or award two marks for array.
	(b)			4	Award one mark for shape of transistors Award one mark for labelling of transistors Award one mark for connecting emitter to base Award one mark for connecting collectors together
			Total	**8**	

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