

# **Design and Technology**

General Certificate of Secondary Education **1957/04**

Systems and Control Technology (Electronics Option)

## **Mark Scheme for June 2010**

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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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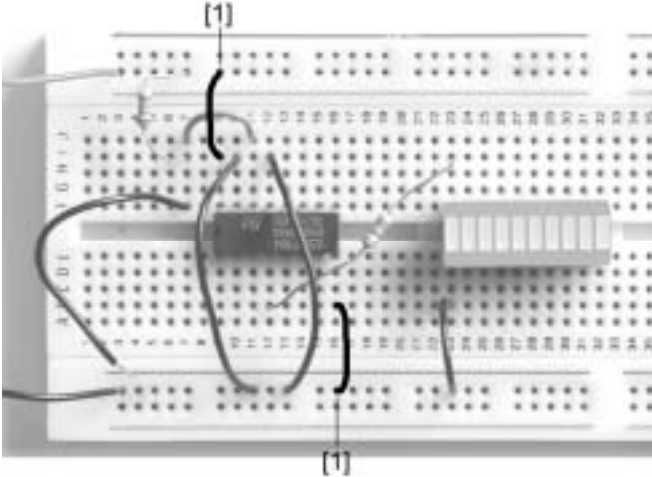
Question	Expected Answer	Mark	Rationale
1 (a)	Benefits of using CAD could include: <ul style="list-style-type: none"> <li>• Accuracy of the drawing;</li> <li>• Ease of changing / updating / copying of the drawing;</li> <li>• Ease of storage for file;</li> <li>• Data can be transferred quickly;</li> <li>• Data can be sent straight to a CNC machine, no need to print.</li> </ul> 1 mark each for 2 valid benefits, 2 x 1	[2]	Allow reference to speed <b>of editing</b> .
(b)	The tolerance is to allow for inaccuracy in either the PCB holes or those produced using the template, mountings / screws will still fit.	[1]	Allow 'drill bit too big' or screw larger than stated diameter.
(c)(i)	The 25mm test line on the template can be measured with a ruler.	[1]	Allow mark for other method that would work in practice e.g. try component for fit, comparison with other template etc.
(c)(ii)	<ul style="list-style-type: none"> <li>• The acrylic template cannot get stretched, expand / contract due to humidity.</li> <li>• Will last longer than the paper template;</li> <li>• The acrylic template will guide the drill without the need for centre punching / marking.</li> </ul> 1 mark for reason, 1 mark for justification / clarity of explanation.	[2]	Allow reference to accuracy of laser cutting with reference to guiding the drill.
(c)(iii)	Methods of accurately securing could include: <ul style="list-style-type: none"> <li>• Drilling one hole and then using this for an alignment screw / bolt;</li> <li>• Adding materials to the sides of template and creating a folded portion that will grip sides;</li> <li>• Using tape or sticky pads to hold template;</li> <li>• Small clamp to hold parts together.</li> </ul> 1 mark for workable method of securing, 1 mark for clear description of method of alignment.	[2]	Must include method of alignment for 2 marks. Allow visual alignment

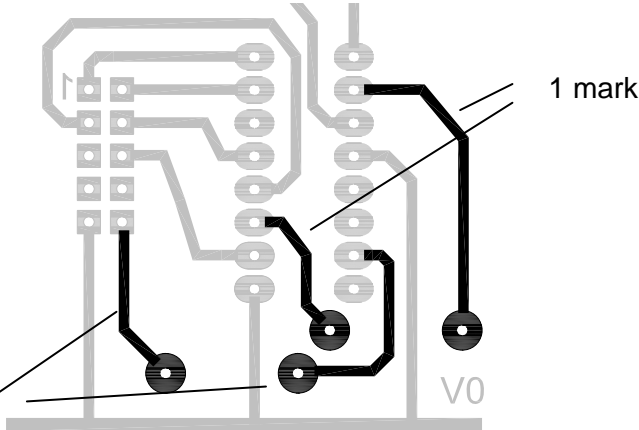
	<b>(d)</b>	Marking should include; <ul style="list-style-type: none"> <li>• A recycling symbol or other indication that the item can be recycled,</li> <li>• Type of material should be marked e.g. PP, HIP, ABS, or number</li> </ul> 1 mark for each of two pieces of information.	<b>[2]</b>	Allow the 'not to be thrown into waste bin' symbol.
		Total	<b>[10]</b>	

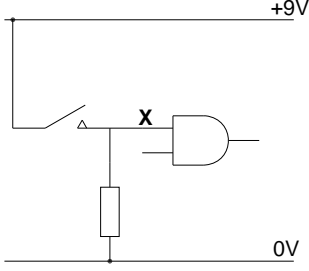
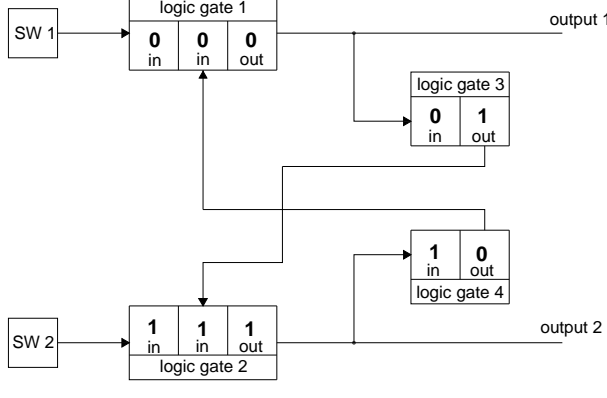
Question	Expected Answer	Mark	Rationale
<b>2 (a)</b>	Any two factors from: <ul style="list-style-type: none"> <li>• Shape/size of detector fits the hand;</li> <li>• Can be used by right and left handed;</li> <li>• Good positioning of controls for either finger or thumb use;</li> <li>• Symbols rather than words used against LEDs;</li> <li>• LED torch included for working in dark areas;</li> <li>• Clear indication of which way 'wood' control turns to increase sensitivity.</li> </ul> 2 x 1 marks for suitable factors.	<b>[2]</b>	Allow reference to smooth edges
<b>(b)(i)</b>	Self tapping screw used as it will cut its own thread into softer plastics material of casing and is unlikely to be used frequently.	<b>[1]</b>	Reduced production time/cost – must be qualified. Allow reference to security of fixing / ease of removal.
<b>(b)(ii)</b>	Symbols applied after moulding because moulding process uses single colour of raw plastics.	<b>[1]</b>	Allow mark for understanding shown e.g. symbols not deformed/melted.
<b>(c)(i)</b>	Wires are held in place with glue as a form of strain relief. Reduced cost compared to other methods.	<b>[1]</b>	'Quicker' or 'cheaper' must be qualified.

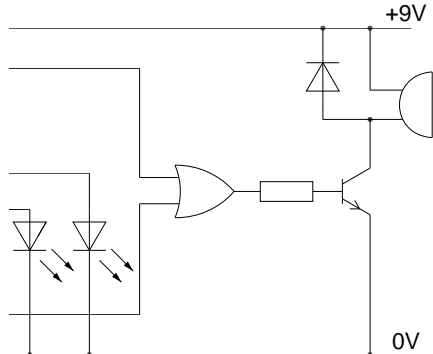
Question	Expected Answer	Mark	Rationale
(c)(ii)	Reasons given could include; <ul style="list-style-type: none"> <li>• The enamelling is on the copper wire as an insulator;</li> <li>• It does not take up as much space as extruded plastic insulation;</li> <li>• Will not be subjected to any abrasion so enamelling is sufficient.</li> </ul> 1 mark for understanding of the reason shown.	<b>[1]</b>	
(d)(i)	Workable method 1 mark. Quality of notes / sketches 1 mark. Methods could include use of a spacer to hold LED in position whilst soldering.	<b>[2]</b>	Allow cutting the legs to length.
(d)(ii)	<ul style="list-style-type: none"> <li>• Bending the radial capacitor requires enough leg to be left above the board to allow a bend to be made.</li> <li>• Bending legs also causes a strain on them.</li> <li>• The shorter style of radial capacitor will not require bending.</li> <li>• Axial capacitors are designed to be fitted flat to the board.</li> </ul> 1 mark for good reason for using suggested alternative methods 1 mark for recognising problems with method shown. 2 x 1 marks.	<b>[2]</b>	
	Total	<b>[10]</b>	

Question	Expected Answer	Mark	Rationale
3 (a)	Method to provide:- <ul style="list-style-type: none"> <li>• waterproofing, 1 mark;</li> <li>• insulation of legs from each other, 1 mark;</li> </ul> Clear description or sketch of <b>workable method</b> , 1 mark.	[3]	Use of shrink wrap over whole thermistor only 1 mark
(b)(i)	1 mark for each correct tick, 2 x 1.  If the + input is greater than the - input the output is high <input checked="" type="checkbox"/> If the - input is greater than the + input the output is high <input type="checkbox"/> If the + input is greater than the - input the output is low <input type="checkbox"/> If the - input is greater than the + input the output is low <input checked="" type="checkbox"/>	[2]	
(b)(ii)	Benefits could include:- <ul style="list-style-type: none"> <li>• smaller circuit / casing;</li> <li>• faster assembly due to reduced part count;</li> <li>• reduced drain on battery;</li> </ul> Allow mark for other valid benefits	[1]	
(c)	Multi-turn variable will allow <b>finer setting</b> to be made, 1 mark.	[1]	Allow any reference to precise or exact nature of setting.
(d)(i)	Substitution into the formula, $7.9 = 12 \times I$ , 1 mark. $I = 7.9 / 12 = \mathbf{658mA}$ or $\mathbf{0.658A}$ (allow $\mathbf{660mA}$ or $\mathbf{0.66A}$ ), 1 mark. Correct answer with no working, allow 2 marks.	[2]	Assume answer is in Amps unless alternative units shown or method of working is clear.
(d)(ii)	<b>800mA</b> , 1 mark. or to match answer in (d)(i)	[1]	
	<b>Total</b>	<b>[10]</b>	

Question	Expected Answer	Mark	Rationale
4 (a)(i)	<p>1 mark for each correct connection. Holes can only be used once.</p> 	[2]	
(a)(ii)	There will be contact bounce with this type of switch and count will not proceed in logical order.	[1]	
(a)(iii)	Maximum count will be 6 before a reset, maximum time is 6 (minutes)	[1]	Allow <b>7 minutes</b> (until LED 6 goes off)
(b)(i)	<p>Benefits of ribbon cable connection could include:</p> <ul style="list-style-type: none"> <li>▪ circuits can be separated;</li> <li>▪ small footprint for circuit;</li> <li>▪ easier than soldering separate wires into board;</li> <li>▪ easy replacement of part of a circuit.</li> </ul> <p>Allow mark for other valid reason.</p>	[1]	Allow speed of assembly or neatness of circuit.
(b)(ii)	The notch is to align the plug and socket so that it will only fit in one way. Allow any reference to one way fit	[1]	

Question	Expected Answer	Mark	Rationale
(c)(i)	<p>1 mark for each correct connection, both parts needed. 2 x 1</p> 	[2]	Both pairs of tracks correct but no pads 1 mark
(c)(ii)	Explanation should include ease of assembly in batch production, time saved in forming links, standard component, easier to fit, easier to handle than link wire.	[2]	1 mark for each valid point or 2 marks for one point well explained.
	<b>Total</b>	<b>[10]</b>	

Question	Expected Answer	Mark	Rationale
5 (a)(i)	<p>Pull down resistor correctly placed and switch connected to positive 1 mark</p> 	[1]	Ignore connections to second leg of gate.
(a)(ii)	<p>Gates 3 and 4 feed the inverted output into the other input of gates 1 and 2 to ensure that both of the AND gates cannot have a logic 1 output at the same time. 1 mark for understanding shown.</p>	[1]	Allow 'creates a flip flop or bistable'
(b)	<p>1 mark for each gate correct, 4 x 1 marks.</p> 	[4]	

Question	Expected Answer	Mark	Rationale
(c)	<p>OR gate correctly inserted, 1 mark. Emitter to ground and buzzer to positive, 1 mark. Allow use of XOR gate.</p> 	[2]	Must be correct symbol for OR gate or XOR.
(d)	<p>Evaluation could include:-</p> <ul style="list-style-type: none"> <li>• Compare cost of components;</li> <li>• Size of circuit;</li> <li>• Consider the speed of assembly / programming time;</li> <li>• Ease of altering delays, time for lights and buzzer on etc;</li> <li>• Potential accuracy – to include testing.</li> </ul> <p>1 mark for objective evaluation point, 1 mark for relevance of point explained or 1 mark each for two relevant points.</p>	[2]	
	<b>Total</b>	<b>[10]</b>	

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