

Design and Technology

General Certificate of Secondary Education **1957/03**

Systems and Control Technology (Electronics Option)

Mark Scheme for June 2010

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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General advice to Assistant Examiners on the procedure to be used

YOU WILL BE REQUIRED TO MARK PRACTICE AND STANDARDISATION SCRIPTS BEFORE STARTING TO MARK LIVE SCRIPTS.

- 1 The schedule of dates for the marking of this paper is very important. It is vital that you meet these requirements. If you experience problems then you must contact your Team Leader (Supervisor) without delay.
- 2 An element of professional judgement is required in the marking of any written paper. Candidates often do not use the exact words which appear in the detailed sheets which follow. If you are in doubt about the validity of any answer then consult your Team Leader (Supervisor) by phone, the messaging system within scoris, or e-mail.
- 3 Correct answers to calculations always gain full credit, even if no working is shown (The “Show your working” instruction is to help candidates, who may then gain credit even if their final answer is not correct.)
- 4 Some questions may have a ‘Level of Response’ mark scheme. Any details about these will be in the Additional Guidance.
- 5 If an answer has been crossed out and no alternative answer has been written then ignore the crossed out answer.
- 6 In addition to the award of 0 marks there is a NR (No Response) option in scoris.

Award 0 marks

- if there is any attempt that earns no credit (including copying out the question or some crossed out working)

Award NR (No Response)

- if there is nothing written at all in the answer space
OR
 - if there is any comment which does not in any way relate to the question being asked (eg ‘can’t do’, ‘don’t know’)
OR
 - if there is any sort of mark which is not an attempt at the question (eg a dash, a question mark)
- 7 The **Abbreviations, annotations and conventions** used in the detailed Mark Scheme are:

[QM to insert]

- 8 The **Comments box** will be use by your PE to explain their marking of the practice scripts. Please refer to these comments when checking your practice scripts.

Any questions or comments you have for your Team Leader should be communicated by phone, via the scoris messaging system, or e-mail.

9 Annotations in scoris

The following annotations are available:

[QM to amend/add others]

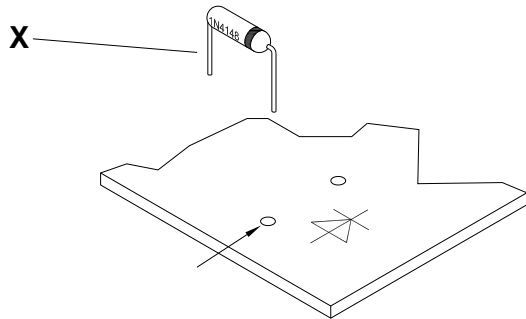
- ✓ = correct response
- ✗ = incorrect response

Highlighting is also available to highlight any particular points on the script.

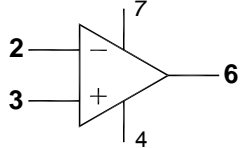
[The following questions should be annotated with ticks to show where marks have been awarded in the body of the text: (QM to add)]

- 10 Please send a brief report on the performance of candidates to your Team Leader (Supervisor) by the end of the marking period. The Assistant Examiner's Report Form (AERF) can be found on the RM Cambridge Assessment Support Portal.

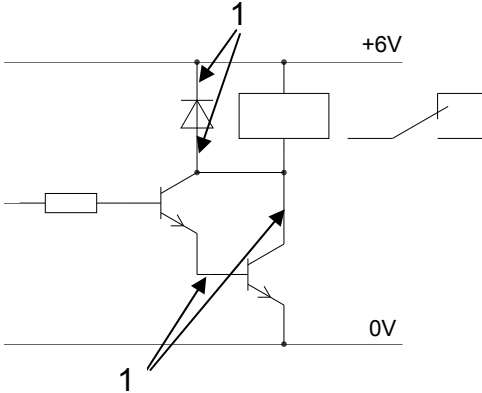
Your report should contain notes on particular strength displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

Question	Expected Answer	Mark	Rationale												
1 (a)(i)	d c a b e , 1 mark for each correct, 4 x 1 <table><tr><th>Feature on component</th><th>component</th></tr><tr><td>flat to show negative end</td><td>d</td></tr><tr><td>colour coded</td><td>c</td></tr><tr><td>coloured band at one end</td><td>a</td></tr><tr><td>notch or dot at pin 1 end</td><td>b</td></tr><tr><td>negative leg is shorter</td><td>e</td></tr></table>	Feature on component	component	flat to show negative end	d	colour coded	c	coloured band at one end	a	notch or dot at pin 1 end	b	negative leg is shorter	e	[4]	
Feature on component	component														
flat to show negative end	d														
colour coded	c														
coloured band at one end	a														
notch or dot at pin 1 end	b														
negative leg is shorter	e														
(a)(ii)	1000μF value of the capacitor, 1 mark 16V working voltage of the capacitor.	[1] [1]	Allow any reference to the highest safe voltage that can be applied.												
(b)(i)	Correct hole indicated, 1 mark. 	[1]													
(b)(ii)	The component will block a signal that is intended to pass through the diode.	[1]	Allow clear reference to the blocking / one way effect or damage to other component(s). Allow 'circuit would not work'.												

Question		Expected Answer	Mark	Rationale
1	(c)	<p>Benefits could include the following:</p> <ul style="list-style-type: none"> • No heat on IC; • IC can be easily replaced; • Upgraded IC can easily be fitted; • IC can always be fitted correct way around without any desoldering; • IC can be used again. <p>1 mark each for two valid points</p>	[2]	
		Total	[10]	

Question	Expected Answer	Mark	Rationale
2 (a)(i)	If thermistor is cooled the resistance reading will increase.	[1]	Allow any reference to increase, e.g. larger, go up, gets bigger.
(a)(ii)	Purpose of VR1 is to set sensitivity / output voltage from thermistors. VR1 sets switching temperature. R3 is current limiting resistor for the transistor.	[1] [1]	Allow 'potential divider'. Allow reference to protection of transistor .
(b)	1 mark for inverting input (2) correct; 1 mark for non- inverting input (3) correct; 1 mark for output (6) correct. 	[3]	
(c)	Fault 1: Desoldering described, allow 'solder sucker', braid, or other practical method Fault 2: Reheat with soldering iron, ensuring that both pad and leg are hot, add more solder if necessary.	[1] [1]	Responses must refer to correction of the faults.
(d)(i)	Flux in solder is to protect component and pad from oxidation, active fluxes also clean, allow either for 1 mark.	[1]	Allow reference to 'helps solder to stick'
(d)(ii)	Lead no longer allowed in solder for manufacturing, 1 mark	[1]	Allow 'led' as a mis-spelling
	Total	[10]	

Question		Expected Answer	Mark	Rationale															
3	(a)(i)	NOR gate, 1 mark.	[1]																
	(a)(ii)	Truth table correctly completed 1 mark. <div><table><tr><td>A</td><td>B</td><td>Q</td></tr><tr><td>0</td><td>0</td><td>1</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>0</td></tr></table></div>	A	B	Q	0	0	1	0	1	0	1	0	0	1	1	0	[1]	Or correct truth table for gate given in 3 (a)(i)
A	B	Q																	
0	0	1																	
0	1	0																	
1	0	0																	
1	1	0																	
	(a)(iii)	Pull down resistors: required to ensure that logic inputs are always at a logic level and not floating.	[1]	Allow mark for understanding shown.															
	(b)	A round hole would allow the switch to rotate during use, 1 mark	[1]	Allow reference to not staying in place.															
	(c)(i)	Substitution into formula $0.360 = 6 \times I$, 1 mark $I = 0.360 / 6 = 0.06\text{A}$ or 60mA , 1 mark. Correct answer with correct units regardless of working, 2 marks	[2]	1 mark for $360 \div 6$ The final answer must have units to match the substitution for both marks.															
	(c)(ii)	Benefits of relay use could include: <ul style="list-style-type: none">• Different voltage possible on the output (siren)• Siren cannot interfere with logic operation• Higher current can be operated• Safe method of switching high voltage. 2 x 1 marks for valid benefits.	[2]																

Question	Expected Answer	Mark	Rationale
(c)(iii)	<p>Darlington pair connections correct 1 mark Diode and relay connections correct 1 mark.</p> 	[2]	Ignore any connections to relay output which do not affect switching of relay.
Total		[10]	

Question	Expected Answer	Mark	Rationale
4 (a)	<p>Benefits of using CAD could include:</p> <ul style="list-style-type: none"> • Accuracy of the drawing; • Ease of changing / updating / copying of the drawing; • Ease of storage for file; • Data can be transferred quickly; • Data can be sent straight to a CNC machine, no need to print. <p>1 mark each for 2 valid benefits, 2 x 1</p>	[2]	Allow reference to speed of editing .
(b)	<p>The tolerance is to allow for inaccuracy in either the PCB holes or those produced using the template, mountings / screws will still fit.</p>	[1]	Allow 'drill bit too big' or screw larger than stated diameter.

Question	Expected Answer	Mark	Rationale
4 (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"> The acrylic template cannot get stretched, expand / contract due to humidity. Will last longer than the paper template; The acrylic template will guide the drill without the need for centre punching / marking. 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"> Drilling one hole and then using this for an alignment screw / bolt; Adding materials to the sides of template and creating a folded portion that will grip sides; Using tape or sticky pads to hold template; Small clamp to hold parts together. 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
(d)	Marking should include; <ul style="list-style-type: none"> A recycling symbol or other indication that the item can be recycled, Type of material should be marked e.g. PP, HIP, ABS, or number 1 mark for each of two pieces of information.	[2]	Allow the 'not to be thrown into waste bin' symbol.
	Total	[10]	

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

Question	Expected Answer	Mark	Rationale
(d)(ii)	<ul style="list-style-type: none"> • Bending the radial capacitor requires enough leg to be left above the board to allow a bend to be made. • Bending legs also causes a strain on them. • The shorter style of radial capacitor will not require bending. • Axial capacitors are designed to be fitted flat to the board. <p>1 mark for good reason for using suggested alternative methods 1 mark for recognising problems with method shown. 2 x 1 marks.</p>	[2]	
	Total	[10]	

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