

A-LEVEL
DESIGN AND TECHNOLOGY:
SYSTEMS AND CONTROL
TECHNOLOGY

SYST1 Materials, Components and Application
Mark scheme

1556
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Version/Stage 1.0: Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Question	Part	Sub Part	Marking Guidance	Mark	Comment
1	(a)		<p><i>A thermoplastic material</i></p> <p>Explanation</p> <p>A plastic that can be deformed when heat is applied</p> <p>Suitable example.</p> <p>(For Example, Acrylic, PVC, Polystyrene Etc.)</p>	<p>1</p> <p>1</p>	Max 2 marks
1	(b)		<p><i>A semiconducting material</i></p> <p>Explanation</p> <p>The conduction properties can be varied</p> <p>Suitable example</p> <p>(For Example, Silicon, Germanium, Etc.)</p>	<p>1</p> <p>1</p>	Max 2 marks
Question	Part	Sub Part	Marking Guidance	Mark	Comment
2	(a)		<p>An Input transducer that can detect a change in temperature.</p> <p>An input transducer that will alter its output Responds to temperature e.g. Thermistor</p>	<p>1</p> <p>1</p>	Max 2 marks
2	(b)		<p>A two Input NAND gate.</p> <p>An AND gate with two inputs and one output Negation circle correctly shown</p>	<p>1</p> <p>1</p>	Max 2 marks
Question	Part	Sub Part	Marking Guidance	Mark	Comment
3			<p>Shaft B: Gear ratio A:B or 20:60 or 1:3 Speed of B = 360/3 or 120rpm</p> <p>Shaft C: Gear ratio B:C or 25:100 or 1:4 Speed of C = 120/4 or 30rpm</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	Max 4 marks
Question	Part	Sub Part	Marking Guidance	Mark	Comment
4	(a)		<p>RL1 coil energises or becomes magnet or DPDT moves</p> <p>RL1 Latches / Locks on</p> <p>L1 off</p>	<p>1</p> <p>1</p> <p>1</p>	Max 6 marks

			RL2 coil energises or becomes magnet or SPDT moves	1	
			RL2 breaks own circuit or oscillates	1	
			L2 flashes	1	
4	(b)		Explain the purpose of switch B in the circuit.		Max 2 marks
			Switches off RL1 (1) switches on L1 or switches off L2 (1)	2	
			OR Resets/Unlatches circuit (2)		
Question	Part	Sub Part	Marking Guidance	Mark	Comment
5	(a)		With the aid of a diagram, describe in detail an electro-mechanical or an electronic system for automatically switching on a set of 230 volt ac traffic lights in sequence:		Max 12 marks
			Red		
			Red and Amber		
			Green		
			Amber		
			Red		
			Power supply for sequencing system	1	
			Power supply for lighting system (230 volt ac)	1	
			Sequencing system shown	1	
			Suitable system for producing a sequence of at least 4 steps	1	
			Explanation / flowchart of how the sequence is generated <i>(up to 3 marks)</i>	3	
			Explanation of how the system copes with 230V requirement <i>(up to 2 marks)</i>	2	
			System fulfils 50% (1) 75% (2) 100% (3) of requirement <i>(up to 3 marks)</i>	3	
5	(b)		With the aid of a diagram, explain any modifications that would be required to the system to enable the length of time each light is on to be set as follows.		Max 4 marks
			Red 55 Seconds		
			Red and Amber 5 Seconds		
			Green 60 Seconds		
			Amber 10 Seconds		

			Method of altering the times explained – partially (1) fully (2) <i>(up to 2 marks)</i>	2	
			Production of 11:1:12:2 ratio – partially (1) fully (2) <i>(up to 2 marks)</i>	2	
5	(c)		<p>Explain two advantages or disadvantages of using LED's for this application in place of 230 volt ac lamps.</p> <p>Advantages – Lower voltage / More light for amount of power used / longer lasting / easier to directly interface / less heat given off / more efficient <i>(up to 2 marks)</i></p> <p>Disadvantages – Multiple LED's required / Limited viewing angle / Matrix effect</p> <p>Each point 1 mark + explanation 1 mark <i>(up to 2 marks)</i></p>	4	Max 2 x 2 marks
Question	Part	Sub Part	Marking Guidance	Mark	Comment
6	(a)		<p>Cutting blank to length – System – Tools – Process <i>(up to 2 marks)</i></p> <p>Marking out / positioning of holes – System – Tools – Process <i>(up to 3 marks)</i></p> <p>Production of holes – System – Tools – Process <i>(up to 2 marks)</i></p> <p>Shaping of ends – System – Tools – Process <i>(up to 2 marks)</i></p> <p>Bending – System – Tools – Process <i>(up to 3 marks)</i></p>	2 3 2 2 3	<p>Max 12 marks</p> <p>If answer is only suitable for one off production not batch – Max 6 marks</p>
6	(b)		<p>Permanent - (Example) Soldering</p> <p>Need for a clean joint or use of flux</p> <p>Explanation of how heat is applied</p> <p>Requirement that the parent metal is hot enough to melt solder</p> <p>Conductivity maintained because solder has</p>	1 1 1	Max 8 marks

			joined to the metal and it is a conductor	1	
			Temporary – (Example) Connecting block / crimp / proto board		
			Need for a clean joint	1	
			Explanation of how pressure is applied – screw / spring	1	
			Requirement for good connection / large contact area	1	
			Conductivity maintained because connector is a conductor	1	
Question	Part	Sub Part	Marking Guidance	Mark	Comment
7	(a)		Suitable system for sensing a car	1	Max 4 marks
			Can only be triggered by a characteristic of a car	1	
			Power supply correctly shown and connected	1	
			Electrical output only produced when a car is present	1	
7	(b)	(i)	Sketch that clearly shows a barrier system	1	Max 2 x 4 marks
			Barrier capable of restricting access	1	
			Barrier capable of allowing access	1	
			Description of transition between two states or reference to prime mover	1	
7	(b)	(ii)	Activation of system by waiting car	1	Max 8 marks
			Suitable method for determining a space is filled	1	
			Suitable method for determining all spaces filled	1	
			System for determining if there is space for the waiting vehicle (1) with output identified (2)	2	
			System capable of continually monitoring the number of cars in the car park (1) altering output as number changes (2) operation fully explained (3)	3	

