ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education
June 2011

Design and Technology Electronic Products 45401

Unit 1: Written Paper

Final

Mark Scheme

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

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COMPONENT NUMBER: 45401

COMPONENT NAME:
New Specification - GCSE Design and Technology (Electronic Products)

FOR EXAMINERS – PLEASE NOTE THAT IF YOU ARE UNSURE HOW TO AWARD A RESPONSE FROM A CANDIDATE, PLEASE SEEK CLARIFICATION OR ADVICE FROM YOUR TEAM LEADER OR THE PRINCIPAL EXAMINER.

Section A

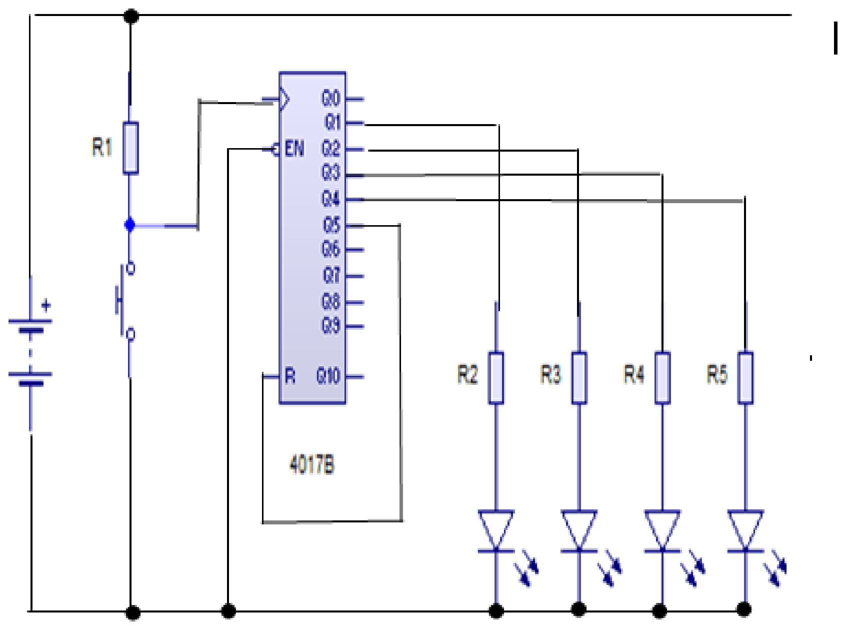
Question	Part	Sub Part	Marking Guidance	Marks
1	a		2 separate block diagrams required: INPUTS Switch types Tilt, LDR, Piezo, Inductive, P-T-B P-T-M, lever micro-switch, reed or any suitable specific input PROCESS BLOCKS comparator, level detection, latch, delay, oscillator Detector or suitable specific process component, logic gate OUTPUT transducers, buzzer, piezo, lamp, bell, LED or other specific output device	 1 mark each 2 maximum 1 mark each 2 maximum 1 mark each 2 maximum Total **(6 marks)**
1	b		Commenting on and highlighting key features form each of the three system blocks (eg; sensitivity, reliability, loudness, size, adjustable or similar) For each system block. 1 mark for each comment	Total **(3 marks)**

1	c		**Suitable for a retail space:** Reference to use in a retail environment; products, shelves; display; size; appearance; deterrent value or other suitable reference - any two criteria met =2 marks or 1 criteria in detail= 2marks	2 marks
			Does not put customer off: Reference to visual appeal, attractive, unobtrusive, indicates in use, positively reinforces security issues or other suitable feature – any two criteria met 2 marks or 1 criteria in detail= 2marks	2 marks
			Product can be handled: Any two references to how products ca be handled eg: wires, loops, inductive, proximity, beam breaking or other suitable method or 1 criteria in detail= 2marks	2 marks
			System can be used for more than one product Any two references to hoops, loops, connectors, multiple inputs, sockets, Series or parallel connections or similar suitable methods or 1 criteria in detail= 2marks	2 marks
			Warns the retailer Reference to output device(s) Simple 1 mark Detailed 2 marks	2 marks
			Switch on and off for device Simple response 1mark Detailed response may include: Key switch, Programme card, Remote switch, Re-set hole with PTM below, Reed switch 2 marks	2 marks
			Power Reference to battery/ battery pack/ housing/ rechargeable 1mark	1 mark
			Quality of communication / Visual communication Attractive 2D sketch/ section view or 3D pictorial view that identifies the principal parts Good clear diagram with design appeal 2 marks Less clear diagram and annotation 1 mark	2 marks Total **(15 marks)**

1	d		General description pointing out features that meet the specification- 1 mark for each of 4 points made	Total **(4 marks)**
1	e		Advantages: 1mark each of 2 Self contained…. No external wires.. Small size…. Low power… Safety Or other suitable response Disadvantages: 1 mark each of 2 More easily disabled.. Batteries running down/out.. Running costs… Limits circuit design Or other suitable response	1 mark each 1 mark each (2 marks) Total **(4 marks)**

Section B

Question	Part	Sub Part	Marking Guidance	Marks
2	a	i	LDR or Light Dependent Resistor	**(1 mark)**
2	a	ii	Any light sensing or activity monitoring or application Including the following: • Sports light levels • Water turbidity • Beam breaking • Sun stroke alarm Or any other suitable application	**(1 mark)**
2	a	iii	Correctly comment that: High light levels = resistance low And Low light (dark) = resistance high	 1 mark 1 mark **(2 marks)**
2	b	i	Sensitivity and response adjusted for LDR 1 mark for identifying VR1 eg: Pre-set , potential divider circuit Adjusts/alters the resistance 1 mark additional for reference to LDR sensitivity adjustment and or Vout	**(2 marks)**
2	b	ii	High speed switching, fast response, low power consumption Wider frequency response, digital, small physical size, more sensitive than LDR (all these could be 'compared with LDR') Simple response 1mark Detailed response 2 marks	**(2 marks)**
2	c	i	Opto-isolator also accept- Opto-switch / Reflective Opto/ Slotted Opto	**(1 mark)**
2	c	ii	Two independent circuits, connecting two circuits at different voltages, protecting secondary circuit, replaces a relay, Low interference using IR 1 mark for simple response, 2 marks for detailed response or two responses	**(2 marks)**

3	a		Correctly connected LEDs R2,R3,R4,R5 Each to Q1,Q2,Q3,Q4 Earth (0 volt) connection from supply to resistors Feedback wire from output Q5 to reset pin Enable pin EN to earth(0 volt) PTM and pull up resistor R1 connected to supply +ve and o volt rail – and to Input > Please use definitive connections shown here 	1 – 4 marks 1 mark 2 marks 2 marks 1 – 2 marks 1 mark Total **(12 marks)**
3	b	i	Mention of Mechanical bounce / sparks/ multiple signals or sparks when switch is pressed	**(1 mark)**
3	b	ii	Debounce circuit Mention of resistor / capacitor / monostable with delay Charge up time / spike elimination / use of a Schmitt trigger Multiple signals/ Program in a delay into PIC input Time delay greater than closing time of switch Simple response 1 mark detailed response 2 marks	1-2 marks **(2 marks)**
4	a	i	Correctly circled SCR	**(1 mark)**
4	a	ii	Any of : Device latches' has two stable states/ bistable device, or comment 'device stays on' Or goes to the high or on position (stays switched on) until reset.	**(1 mark)**

4	b		Simple response for 1 mark ' eg; to keep the buzzer going OR to maintain current path Detailed response for 2 marks; Purpose of Resistor to maintain a current path for SCR as the buzzer turns on and off OR The thyristor would be switched off by the buzzer without a current path Or other explanation	**(2 marks)**
4	c		Simple response for 1 mark eg: Turns on the SCR OR buzzer comes on/or stays on Detailed response for 2 mark eg : PTM A causes 2 volts to be applied to the gate or A low resistance is created between the Anode and Cathode of the SCR or The SCR turns on and stays on	**(2 marks)**
4	d		PTM B turns SCR and buzzer off for 1 mark For detailed response 2^{nd} mark: PTM bypasses SCR Anode/cathode to reset Thyristor, or diverting current creates a low resistance path for current	**(2 marks)**
4	e		For 1 mark must ref: To limit the current through the switch A and / or to limit the current to the SCR For 1 mark also refers to voltage control for gate of SCR	**(2 marks)**
5	a		Any three products that are associated with PIC microcontrollers Eg: cooker, microwave, stereo, handset, alarm, TV, central heating, boiler or **similar domestic** products	1-3 marks **(3 marks)**
5	b		Two reasons must be stated including any 2 of the following PIC allows pre-programming PIC allows programme revisions/ changes Greater complexity of programme function More outputs and inputs available More reliable switching Faster and or shorter sequences Fewer components required Smaller circuit size Or other suitable reasons	1 mark per reason **(2 marks)**

5	c		<u>Advantage</u> of Flowchart: Simpler to use and learn / graphical- symbols easy to identify/ easy to communicate and share ideas / speed of design. Can be converted to BASIC OR <u>Advantage</u> of BASIC prog: More powerful programming tool / can be edited for alterations easier than a drawing / debugged better than a graphic programme / more detailed/ 1 mark for each advantage 2 marks for a detailed explained advantage	**(3 marks)**
5	d		This answer needs clear structure: Start – 1 mark Decision(s) (eg: If based on input) - 2 marks Random (or **RND**) - 2 marks OR Multiple **IF** decisions - 2 marks OR Increment /decrement – 2 marks Output (A or B or C) high command (correctly identified) 2 marks Delay instruction 'Wait' 1mark Output low command 1 mark Loop – (eg: return to main or start) 1 mark (Note: no marks for quality of drawing)	Total **(10 marks)**
6	a		To save battery Reduce annoyance To allow the switch to be pressed again	**(1 mark)**
6	b		Simple response 1mark eg: change capacitor/resistor Detail response 2 marks eg: delay can be changed using a different value capacitor/ resistor value or variable capacitor or resistor	**(2 marks)**
6	c	i	T=RxC or any variation e.g. 1.1RC	**(1 mark)**
6	c	ii	Calculation 1 mark for Transposition and 1 mark for Values Accept T/C or seconds/Farads for 1 mark Accept unit values 10 seconds and 1000μF for 1 mark OR accept also 1x10-3 F or Farads for 1 mark	**(2 marks)**

6	c	iii	10K Or 10,000 Ω Also Accept 91K (for those candidates that used 1.1RC calculation	**(1 mark)**
6	c	iv	330Ω-100K	**(1 mark)**
6	c	v	Simple response 1 mark : Pull up resistor , Pin 2 voltage level high Detailed response for 2 marks: Bias resistor for PTM, trigger takes pin 2 to 0v OR To ensure a –ve voltage swing when PTM is pressed	**(2 marks)**
7	a	i	Correctly named ‘**OR’** gate / OR GATE/ OR LOGIC GATE	**(1 mark)**
7	a	ii	<table><tr><th>B</th><th>A</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table> Truth table entries AB sequence correct	1 mark each 1-3 marks **(3 marks)**
7	b		Graphic clearly showing high and low ‘squared’ logic signals 1mark labelled as digital 1mark Graphic showing gradual transition and gradients of ‘analogue’ levels 1 mark labelled as analogue 1mark	**(4 marks)**

8	a		Suitable specification/ factors to include: Three factors considered; Three responses required Basic consideration 1 mark Qualified response 2 marks size, and shape/weight output types signals ergonomics, attachment methods, power, impact strength, construction, lifespan, cable attachment, Battery location all likely response areas	1-2 marks for each **(6 marks)**
8	b	i	Need to code / decode signal Extra circuit required In-line (directional)with receiver Line of sight Reference to distance Or other relevant response	**(1 mark)**
8	b	ii	Smaller device so less space needed Longer range Response Accuracy No lead required Or other relevant response	**(1 mark)**

8	c		QWC question - Will include some reference to some of these key words to achieve 1-4 marks PCB design Surface mount Moulding techniques Low cost Accurate Complex shape Easy to reproduce Surface detail Production methods Vacuum, injection mould, laser cutting Any suitable production materials QWC Poor coverage with significant error 1mark Coverage with some significant error 2 marks Good coverage with little grammatical error 3 marks Excellent with no obvious errors 4 marks	1-4 marks for technical details 1-4 marks QWC Total **(8 marks)**

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