Version 1.0

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Design and Technology: Systems and Control Technology
(Subject Code 3546/Foundation)

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The answers given in the following mark schemes are neither exhaustive nor exclusive. Candidates whose answers do not appear directly on the mark scheme, but who have demonstrated knowledge, understanding, or skills relevant to the question will receive appropriate credit for their answers.

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ASSESSMENT & QUALIFICATIONS ALLIANCE

GENERAL CERTIFICATE OF SECONDARY EDUCATION

June Examination 2004

Design and Technology: Systems and Control Technology

Foundation Tier – Section A Mechanisms Focus

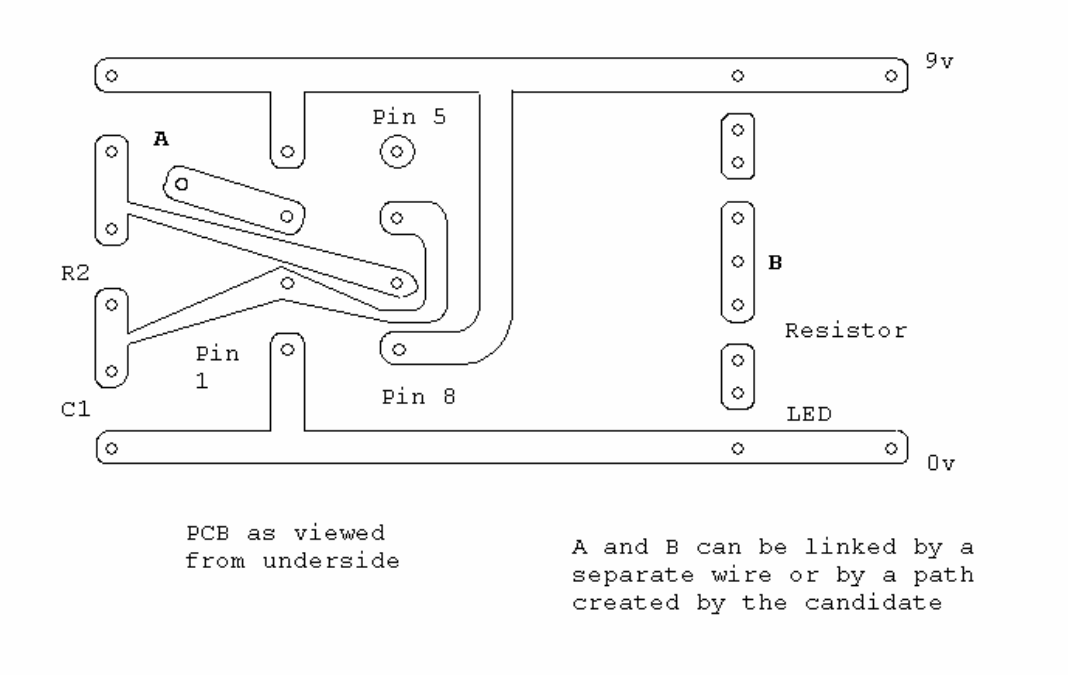
Question 1

(a)	Drawing a plate cam/pear cam/circular cam/offset cam	1 mark
	Largely correct profile	1 mark
	Quality of response	
	very good = 2 - understandable = 1	2 marks
		4 marks
(b)	Identification of a crank	1 mark
	Drawing an offset	1 mark
	Quality of response	
	very good = 2 - understandable = 1	2 marks
		4 marks
(c)	Reciprocating = 2 – linear or other similar = 1	2 marks
		2 marks
(d) (i)	Quality of response	2 mark
	Well positioned and understandable = 2 - understandable = 1	
	Pressure pad, PIR, light sensor or other reasonable response	1 mark
(d (ii)	Quality of response	2 mark
	Well positioned and understandable = 2 - understandable = 1	
	Pressure pad, PIR, light sensor or other reasonable response	1 mark
		6 marks
		Total 16 marks

Question 2

(a) (i)	Transistor	1 mark
	Switches current between different LED circuits/amplification	1 mark
(a) (ii)	Capacitor	1 mark
	Acts as a time delay before current switches/stores charge	1mark
(a) (iii)	Resistor	1 mark
	Restrict the current passing into components/reference to voltage	1 mark
(a) (iv)	Resistor & Capacitor - B & C	2 mark
		8 marks

(b)



Correct position 1 mark
Correct holes/track 1 mark

8 marks
Total 16 marks

Question 3

(a) Nylon/aluminium/steel NO GENERICS 1 mark

(b) (i) 1 mark for hard wearing
1 mark for ease of manufacture
2 marks

3b (ii) Folding/rolling/fabrication method described 1 mark

3c Suitable method –
entirely appropriate – welded stop, end plate etc. Include fixing (no glue) 2
weak solution 1

Appropriate notes
Clear description that aids drawing 2
Little in the way of description 1

Quality of drawing
very good = 2 - understandable = 1

10 marks

(d) Quality of drawing
very good = 2 - understandable = 1 — 2 marks

Suitable method –
entirely appropriate – 2 Rod and door must connect
weak solution 1 Rod and door must connect

Mechanism used will give movement 1
will give small movement to large 1

Good/appropriate fixing to rod (pin/screw) 2
Inappropriate/weak 1 — 6 marks

8 marks

Total 18 marks

Question 4

(a) Keypad – logic check – solenoid (l for each in correct position) **3 marks**

(b) (i) Using a low voltage circuit to act as a
Switch to large voltage circuit 2 marks
(if interfacing is described with no mention of voltages (1 mark) 2 marks
'Switching' = 1 mark reference to solenoid operation (1 mark)

(b) ii Voltage passing through coil (1 mark)
Movement of solenoid core
OR Electrical to linear mechanical (1 mark) — 2 marks

4 marks

(c) 10 digit pad — 1 mark
screen — 1 mark
Cancel button — 1 mark
On/off button — 1 mark
Drawing Quality — 2 mark

Case suitability and fixing
Very good = 3 – average quality = 2 – poor can be understood = 1 — 3 marks
Fixing to wall no credit

9 marks

(d) Technical solution
Appropriate sizes/practicality/appropriate design (1 mark each) — 3 marks

Quality of communication
3 very good graphical communication 3D
2 good communication 2D or 3D
1 understandable drawing — 3 marks

6 marks

Total 22 Marks

Question 5

(a)	Correct Style	1 mark
	Correct number of ropes	1 mark
	Number of wheels on pulley 1	1 mark
	Number of wheels on pulley 2	1 mark
	Correct positioning of pull string	1 mark
	Quality of drawing Very good = 2 – understandable = 1	2 marks
		7 marks
(b) (i)	Correct ratio – small to large	1 mark
	Quality of drawing Very good = 2 – understandable = 1	
		3 marks
(b) (ii)	Labelling Driver and Driven 1 each	
		2 marks
(b) (iii)	Correct formula used and transposed $40 \times \frac{4}{1} = 160$	1 mark
	Correct figures inserted	1 mark
	160 Teeth or 10 Teeth	1 mark
		3 marks
		Total 15 Marks

Question 6

(a)	Move trolley out	1 mark
	Lower hook	1 mark
	Raise load	1 mark
	Move trolley in	1 mark
		4 marks
(b)	Correct symbol for LDR	1 mark
	Correct symbol variable resistor	1 mark
	Correct orientation	1 mark
	Good quality drawing	1 mark
		4 marks
(c)	Calibration or setting the light level for LDR operation Reference to voltage control = 1	
		2 marks

(d) (i)	Correct formula	$R_T = R_1 + R_2$	1 mark
	Correct substitution		1 mark
	Correct answer	2K	1 mark
			3 marks

(d) (ii)	Correct formula	$\frac{1}{Rt} = \frac{1}{R1} + \frac{1}{R2}$ or alternative	1 mark
	Correct substitution of figures		1 mark
	Correct answer	500R	1 mark
			3 marks

Total 16 marks

Question 7

(a) (i)	Auto-routing, testing & modelling, produces PCB mask or other suitable. Quality/Lower cost/ consistency/ accuracy saves time/prototyping	1 mark
(ii)	Auto-routing, testing & modelling, produces PCB mask or other suitable	1 mark
		2 marks
(b)	Need to know how to use PC, Expensive or other suitable computer malfunction	1 mark
		1 mark
(c)	Place circuit board and mask into light box	1 mark
	Expose to ultra violet light	1 mark
	Place in etch tank	1 mark
	Remove and clean	1 mark
	Drill holes	1 mark
		5 marks
(d)	Fumes, eye protection, skin protection, clothing protection or other suitable (1 each)	
		2 marks

Total 10 marks

Question 8

(a) (i)	Continuity check, check not loose, check polarity, short circuits etc.	1 mark
	Suitable justification to match the check	1 mark
	Appropriate action following the failure	1 mark
		3 marks
(a) (ii)	Continuity check, check not loose, check polarity, short circuits etc.	1 mark
	Suitable justification to match the check	1 mark
	Appropriate action following the failure	1 mark

3 marks

(b)	Voltage or resistance or current, continuity	1 mark

1 mark

(c)	Less to replace if a fault occurs – ease of handling – lower unit cost to produce or other suitable easy to upgrade Transport/easy to carry = 0	1 mark

1 mark

(d (i)	Reworked	1 mark
(d) (ii)	Recycled	1 mark
(d) (iii)	Scrapped	1 mark
(d) (iv)	Scrapped	1 mark

4 marks

Total 12 marks

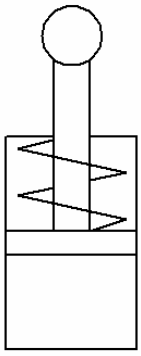
PAPER TOTAL **125**

Section B - Pneumatics Focus

Question 1

(a) Drawing a single acting cylinder — 1 mark
Positioning of spring for return — 1 mark

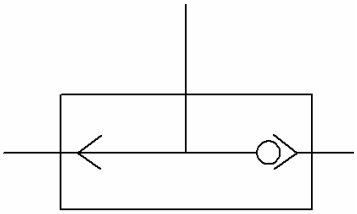
Quality of response
very good = 2 – understandable = 1 — 2 marks



4 marks

(b) Identification of a shuttle valve — 1 mark
Correct connection of lines — 1 mark

Quality of response
very good = 2 - understandable = 1 — 2 marks



4 marks

(c) Reciprocating = 2 – linear or other similar = 1 — 2 marks

2 marks

(d) (i) Quality of response — 2 mark
Well positioned and understandable = 2 - understandable = 1
Pressure pad, PIR, light sensor or other reasonable response — 1 mark

(d (ii) Quality of response — 2 mark
Well positioned and understandable = 2 - understandable = 1
Pressure pad, PIR, light sensor or other reasonable response — 1 mark

6 marks

Total 16 marks

Question 2

(a) (i) Transistor — 1 mark
Switches current between different LED circuits/accept amplification — 1 mark

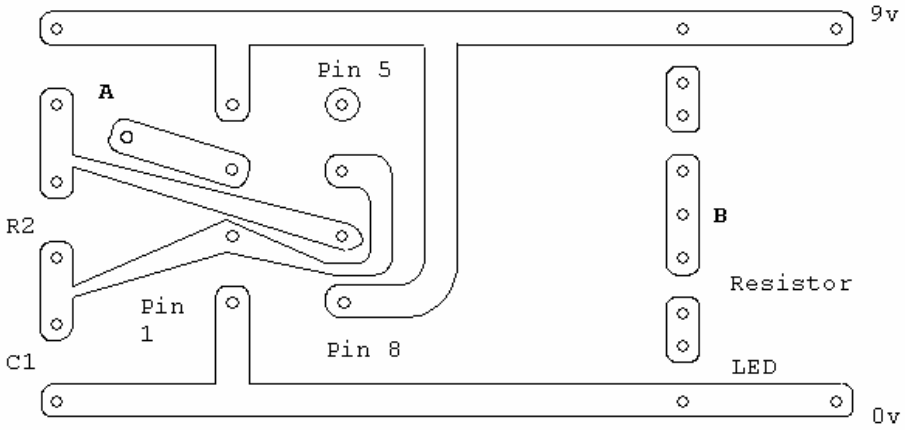
(a) (ii) Capacitor — 1 mark
Acts as a time delay before current switches/stores charge — 1 mark

(a) (iii) Resistor — 1 mark
Restrict the current passing into components/reference to voltage — 1 mark

(a) (iv) Resistor & Capacitor - B & C — 2 marks

8 marks

(b)



Correct position 1 mark
Correct holes/track 1 mark **8 marks**

Total 16 marks

Question 3

(a) Nylon/aluminium/steel NO GENERICS 1 mark

(b) (i) 1 mark for hard wearing
1 mark for easily produced/manufactured 2 marks

(b) (ii) Folding/rolling/ fabrication method described 1 mark

(c) Suitable method –
entirely appropriate – welded stop, end plate etc. Include fixing (no glue) 2
weak solution 1

Appropriate notes
Clear description that aids drawing 2
Little in the way of description 1

Quality of drawing
very good = 2 - understandable = 1

6 marks

(d) Quality of drawing
very good = 2 - understandable = 1 — 2 marks

Suitable method –
entirely appropriate – Rod and door must connect 2
weak solution Rod and door must connect 1

Mechanism used will give movement 1
will give small movement to large 1

Good/appropriate fixing to rod (pin/screw) 2
Inappropriate/weak 1 — 6

8 marks

Total 18 marks

Question 4

(a) Keypad – logic check – solenoid (1 for each in correct position)

3 marks

(b) Using a low voltage circuit to act as a
(i) Switch to large voltage circuit 2 marks
(if interfacing is described with no mention of voltages (1 mark) — 2 marks
'Switching' = 1 mark reference to solenoid operation = (1 mark

(b) Voltage passing through coil (1 mark)
(ii) Movement of solenoid core
OR Electrical to linear mechanical (1 mark) — 2 marks

4 marks

(c) 10 digit pad — 1 mark
screen — 1 mark
Cancel button — 1 mark
on/off button — 1 mark
Drawing Quality — 2 marks

Case suitability and fixing
Very good =3-average quality=2-poor but can be understood=1 — 3 marks
Fixing to wall no credit

9 marks

(d) Technical solution
Appropriate sizes/practicality/appropriate design (1 mark each) — 3 marks

Quality of communication
3 very good graphical communication 3D
2 good communication 2D or 3D
1 understandable drawing — 3 marks

6 marks

Total 22 marks

Question 5

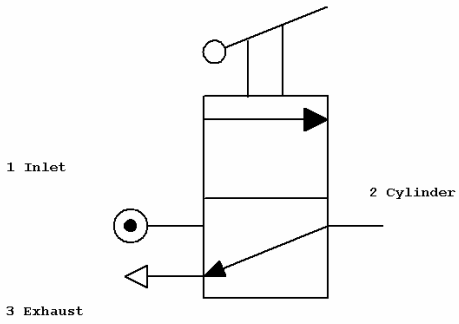
(a) Use of formula Force = Pressure * Area
Correct substitution Force = 1.5 * 100
Correct answer = 150
Correct units Newtons

4 marks

(b) (i) One mark for each
Correct connection in top block – horizontal 1
Correct connection of 2 to 3 2 to cylinder – 3 to exhaust 1
Correct completion of exhaust symbol at 3 1
Good quality drawing 1 (poor quality 0 marks)

4 marks

(b) (ii) Correct label of inlet 1 mark
Correct label of exhaust



(b) (ii) Correct label of inlet
Correct label of exhaust

2 marks

(b) (iii) Any two from

Do not blow air at self or others
Connect components before switching on air to avoid writhing lines
Avoid air lines crossing floors and working areas
Other suitable answers MUST relate to air lines not components

2 marks

5 (b) iv Stage 1 – turn off or disconnect air
Stage 2 – replace component
Stage 3 – reconnect air line and test the valve

3 marks
Total 15 marks

Question 6

(a) Move trolley out 1 mark
Lower hook 1 mark
Raise load 1 mark
Move trolley in 1 mark

4 marks

(b)	Correct symbol for LDR		1 mark
	Correct symbol variable resistor		1 mark
	Correct orientation		1 mark
	Good quality drawing		1 mark
			4 marks
(c)	Calibration or setting the light level for LDR operation		
	Reference to voltage control = 1		**2 marks**
(d) (i)	Correct formula	$R_T = R_1 + R_2$	1 mark
	Correct substitution		1 mark
	Correct answer	2K	1 mark
			3 marks
(d) (ii)	Correct formula	$\frac{1}{Rt} = \frac{1}{R1} + \frac{1}{R2}$ or alternative	1 mark
	Correct substitution of figures		1 mark
	Correct answer	500R	1 mark
			3 marks
			Total 16 marks

Question 7

(a) (i)	Auto-routing, testing & modelling, produces PCB mask or other suitable. Quality/lower cost/ consistency/ accuracy saves time/prototyping		1 mark
(a) (ii)	Auto-routing, testing & modelling, produces PCB mask or other suitable		1 mark
			2 marks
(b)	Need to know how to use PC, Expensive or other suitable computer malfunction		1 mark
			1 mark
(c)	Place circuit board and mask into light box		1 mark
	Expose to ultra violet light		l mark
	Place in etch tank		1 mark
	Remove and clean		1 mark
	Drill holes		1 mark
			5 marks
(d)	Fumes, eye protection, skin protection, clothing protection or other suitable (1 each)		
			2 marks
			Total 10 marks

Question 8

(a) (i)	Continuity check, check not loose, check polarity, short circuits etc. Suitable justification to match the check Appropriate action following the failure	1 mark 1 mark 1 mark
		3 marks
(a) (ii)	Continuity check, check not loose, check polarity, short circuits etc. Suitable justification to match the check Appropriate action following the failure Transport/easy to carry = 0	1 mark 1 mark` 1 mark
		3 marks
(b)	Voltage or resistance or current, continuity	1 mark
		1 mark
(c)	Less to replace if a fault occurs – ease of handling – lower unit cost to produce or other suitable. Easy to upgrade	1 mark
		1 mark
(d) (i)	Reworked	1 mark
(d) (ii)	Recycled	1 mark
(d) (iii)	Scrapped	1 mark
(d) (iv)	Scrapped	1 mark
		4 marks
		Total 12 marks
	PAPER TOTAL	**125**