Version 1: 0905

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Design and Technology: System and Control Technology Unit 1
Specification 5556

Mark Scheme

2005 examination - June series

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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

Quality of Written Communication

The following marks are allocated to the quality of the candidate's written communication. Make a separate assessment of the candidate's overall ability as demonstrated across the paper using the criteria given below.

Performance Criteria	Marks
The candidate will express complex ideas extremely clearly and fluently. Sentences and paragraphs will follow on from one another smoothly and logically. Arguments will be consistently relevant and well structured. There will be few, if any, errors of grammar, punctuation and spelling.	4
The candidate will express moderately complex ideas clearly and reasonably fluently, through well-lined sentences and paragraphs. Arguments will be generally relevant and well structured. There may be occasional errors of grammar, punctuation and spelling.	3
The candidate will express straightforward ideas clearly, if not always fluently. Sentences and paragraphs may not always be well connected. Arguments may sometimes stray from the point or be weakly presented. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.	2
The candidate will express simple ideas clearly, but may be imprecise and awkward in dealing with complex or subtle concepts. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling may be noticeable and intrusive, suggesting weaknesses in these areas.	1

NB This mark scheme is intended as a guide to the type of answer expected but is not intended to be exhaustive or prescriptive. If candidates offer other answers which are equally valid **they must be given full credit.**

Many responses at this level are assessed according to the **quality** of the work rather than the number of points included. The following level descriptors are intended to be a guide when assessing the quality of a candidate's response.

The candidate has a basic but possibly confused grasp of the issues. Few correct examples are given to illustrate points made. Description may be unclear.

(low mark range)

The candidate has some knowledge but there will be less clarity of understanding. Some correct examples given to illustrate points made. Description better but unclear or confused in parts.

(mid mark range)

The candidate has a thorough understanding of the issues and has provided relevant examples to support the knowledge shown. This candidate's answer shows clear evidence of understanding.

(high mark range)

Unit 1

Question 1

(a) Any four valid responses outlining the differences between the sub-divisions in each of the three material groups.

e.g. Woods
Natural timber requires seasoning before use.
Natural timber is only available in limited widths of board.
Manufactured boards are generally more stable in use than natural timber.
Manufactured boards are available in larger sheet sizes than natural timber. (4 x 1 mark)

e.g. Metals
Ferrous metals are generally more susceptible to corrosion than non-ferrous metals.
Some non-ferrous metals are difficult to join by welding.
A number of non-ferrous metals are toxic. (4 x 1 mark)

e.g. Plastics
Thermoplastics can be heated and reshaped many times without structural change.
Thermoplastics are more flexible than thermosets.
Thermoset plastics can only be shaped once.
Thermoset plastics are more resistant to high temperatures than thermoplastics. (4 x 1 mark)

(b) Annotated sketches of any two mechanical systems that convert rotary motion into reciprocating motion. e.g. Crank and Slider, Cam and Follower, etc. (2 x 5 marks)
Rack and pinion not acceptable
Award 1 mark for indication of reciprocating motion of rack
Clarity of sketches. (2 x 1 mark)

(c) Any suitable method of generating a reciprocating stroke length of 50mm with a mechanical system.
e.g. Crank and Slider or Cam and Follower.
Full marks can only be gained for highlighting:
Con-rod pivot point at 25mm from centre of rotation to crank (crank and slider).
Difference between tdc and bdc equals 50mm (cam and follower). (3 marks)

Quality of sketch. (1 mark)

(d) Annotated sketch of a suitable electrical or pneumatic method of directly producing reciprocating motion. e.g. Solenoid, Piston, muscle wire, etc. (3 marks)

Quality of sketch. (1 mark)

(e) Annotated sketch of a suitable lubrication system, indicating the method of operation. e.g. Splash Lubrication or Pressure/Pump Lubrication. (4 marks)

Quality of sketch(es) (2 marks)

(f) Any two suitable materials. e.g. Nylon, PTFE, Graphite, Air. (2 marks)

Total 40 marks

Question 2

(a) Suitable explanation of circuit operation.
Full marks can only be gained by including reference to:
Time delay is created by RC network. (1 mark)
Capacitor charging slowed by resistor (1 mark)
As capacitor charges voltage at base of transistor rises. (1 mark)
As voltage rises above transistor switch on voltage lamp lights (1 mark)

(b) Suitable explanation of resistor slowing discharge of capacitor to prevent damage to switch contacts. (2 marks)

(c) Increase the value of R_1 (1 mark)
Increase the value of C_1 (1 mark)

(d) Gain = 220 (1 mark)
Gain = I_c/I_b (1 mark)
I_b = 60mA/220 (1 mark)
I_b = 0.27mA (2 marks)

(e) Any two valid responses, with explanation of the voltage, current or power ratings of the transistor not being suitable for this application. (4 marks)
e.g.
V_{ce} is 30V maximum and the bulb requires 50V.
I_c is 100mA maximum and the bulb requires 2A.
P_{tot} is 500mW and the bulb requires 100W.

(f) Any suitable switching circuit. (6 marks)
e.g. Relay, Opto-isolator, etc.

Quality of sketch. (1 mark)
Correct symbols. (1 mark)

(g) Any three suitable safety precautions. (3 marks)

e.g.
Danger of burns from soldering iron.
Toxicity of lead content of solder.
Irritant fumes from rosin flux solder.
Don't overheat components
Polarity of components observed

Total 28 marks

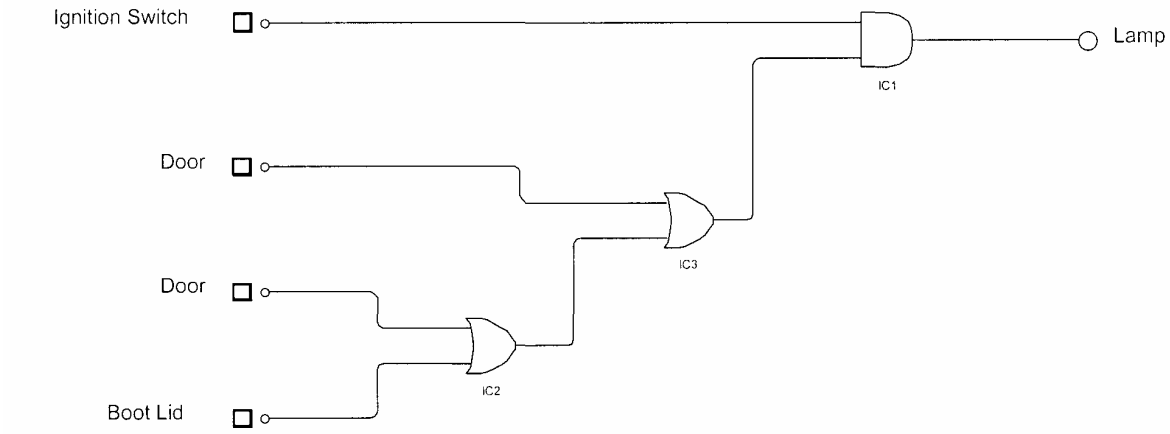
Question 3

(a)

Door	Door	Boot Lid	Ignition	Lamp
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

(8 marks)

(b) e.g.



(8 marks)

(c) Any suitable definition of an astable, which indicates a constantly changing voltage or logic level. (2 marks)

(d) Any suitable circuit able to produce an astable output signal of a frequency suitable for driving a loudspeaker. (8 marks)
e.g. 555 timer, Logic gate astable, transistor astable.
Quality of circuit diagram. (2 marks)

Total 28 marks

Question 4

(a)	Any three suitable definitions of the production methods.	(3 x 2 marks)
(b)	Any four valid responses for each method, outlining their use.	(2 x 4 marks)
	Quality of sketches.	(2 x 2 marks)
(c)	Simplistic answer giving basic outline of the use of CAD/CAM but with little or no comparison with the use of jigs and templates.	(1-3 marks)
	Good answer comparing the use of CAD/CAM with jigs and templates with some discussion of the advantages and disadvantages.	(4-7 marks)
	Excellent answer giving an in-depth discussion of the advantages and disadvantages of using CAD/CAM compared with the use of jigs and templates.	(8-10 marks)

Answers should include some or all of the following observations:

Holes/shapes cut by template are only as accurate as the template.
Templates could be damaged if they are used as a guide for drilling/cutting.
Jigs will wear in time causing possible misalignment of the item to be machined.
CAD/CAM has a very high initial cost.
CAD/CAM operation requires a high level of training of staff.

Total 28 marks