GCE

Design and Technology: Systems and Control Technology

Mark scheme

SYST3
June 2015

Version 1: 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.

Further copies of this Mark Scheme are available from aqa.org.uk

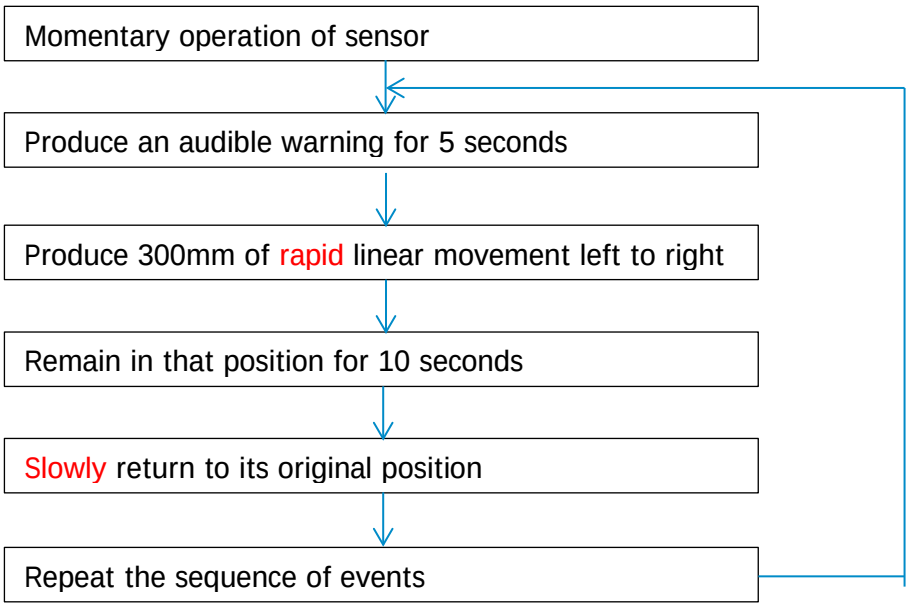
01	Discuss the relative advantages of using finite and non-finite energy sources for meeting the energy requirements of communities on isolated islands in the UK. Answers should make reference to; Availability – suitability – adaptability – storage – distribution – connectivity – cost – continuity of supply – pollution – weather conditions – construction costs – running cost – short and long term costs maintenance – security of supply - etc. **Marks awarded as follows:** • Basic information with evidence of only simplistic understanding. Candidate will probably offer only a narrow range of obvious suggestions with few, if any, appropriate examples to support points made, and possibly lack understanding of the concept. There will be many inaccuracies and confusion. 0 - 5 • Candidate shows some sound knowledge and understanding but there will be a lack of precise and accurate detail, at the lower end of the mark range. A number of relevant examples will be given. There are likely to be some inaccuracies and misunderstandings, especially at the lower end of the range. Straightforward ideas are expressed reasonably clearly. 6 - 10 • Candidate shows detailed knowledge and understanding of a wide variety of issues and gives a wide range of relevant examples. The information will be detailed and accurate. Complex ideas will be expressed clearly. 11 - 16	**16 marks**
02	Describe in detail how **two** of the following could be used to charge a 12 volt battery on an ocean going yacht. • Wind power • Solar power • The yacht's movement through the water. Your answer should make reference to harnessing the power source, energy conversion and how a suitable output is produced. **Marks awarded as follows:** Reference to the nature of the energy sources characteristics (1) Harnessing of the energy source (1) Conversion system (1) with explanation (1) (2) Explanation of how correct charging parameters achieved (2)	**2 x 6 marks**

03	With reference to a range of applications, compare the relative advantages of **three** different systems for the transfer and amplification of rotary motion. Answers should use examples and make reference to; Loading on the system - Working speed of the system - Accuracy requirements - Input requirements - output requirements - Operating characteristics - Maintenance – - Reliability - Flexibility of application – Amplification requirements –ease of use **Marks awarded as follows:** • Basic information with evidence of only simplistic understanding. Candidate will probably offer only a narrow range of obvious suggestions with few, if any, appropriate examples to support points made, and possibly lack understanding of the concept. There will be many inaccuracies and confusion. 0 - 5 • Candidate shows some sound knowledge and understanding but there will be a lack of precise and accurate detail, at the lower end of the mark range. A number of relevant examples will be given. There are likely to be some inaccuracies and misunderstandings, especially at the lower end of the range. Straightforward ideas are expressed reasonably clearly. 6 - 10 • Candidate shows detailed knowledge and understanding of a wide variety of issues and gives a wide range of relevant examples. The information will be detailed and accurate. Complex ideas will be expressed clearly. 11 - 16	**16 marks**
04	With reference to specific examples explain when and why you would use anthropometric data related to 90% of the population. **Marks awarded as follows: (**The emphasis is on the why) • Basic information with evidence of only limited understanding or knowledge. There will probably be a lack of specific information. There will be inaccuracies and confusion. 0 -2 • Candidate shows some sound knowledge but there will be some lack of detail and reference to specifics. The candidate has a good grasp of the methods and there suitability, but there is a lack of detail. Straightforward ideas are expressed clearly. 3 -5 • Candidate shows detailed knowledge and understanding of the methods and will clearly explain the reasons why they are suitable, especially at	

		the top end of the mark range. There will be a variety of examples to support points made. Complex ideas will be expressed clearly. 6 - 8	**8 marks**

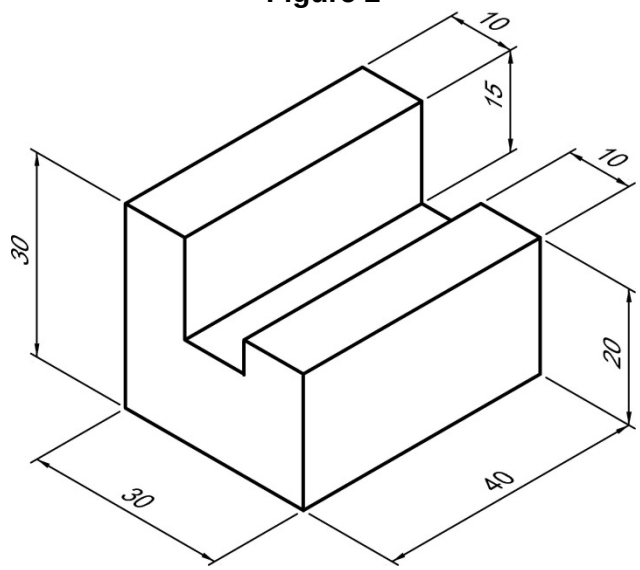
05	Discuss why using the average measurements of a representative sample of the population is not necessarily a good idea when designing seating. **Marks awarded as follows: (**The emphasis is on the why) o Basic information with evidence of only limited understanding or knowledge. There will probably be a lack of specific information. There will be inaccuracies and confusion. 0 -1 o Candidate shows some sound knowledge but there will be some lack of detail and reference to specifics. The candidate has a good grasp of the principles but there is a lack of detail. Straightforward ideas are expressed clearly. 2 -3 o Candidate shows detailed knowledge and understanding of the principles and will clearly explain the reasons why they are not suitable. There will be a variety of examples to support points made. Complex ideas will be expressed clearly. 4	**4 marks**
06	With reference to a different system or product for each property, explain in detail why the following are important in material selection. • Thermal conductivity • Hardness • Tensile strength • Toughness **Marks awarded as follows:** Reference to a specific example explaining when property is required (1mark) Reference to when this happens (1mark) Explanation of why this property is important (1mark) How this property allows the example to function (1mark)	**4 x 4 marks**

07	Discuss the environmental advantages and performance limitations of electrically powered vehicles. Answers should use examples and make reference to; Pollution – secondary pollution – Tertiary pollution – noise – cost – not necessary use of finite resources – efficiency – less wasted energy - Need to carry power source – limitation of energy quantity – lack of re-charge facilities – range – top speed – torque to quiet **Marks awarded as follows:** • Basic information with evidence of only limited understanding or knowledge. There will probably be a lack of specific information. There will be inaccuracies and confusion. 0 -4 • Candidate shows some sound knowledge but there will be some lack of detail and reference to specifics. The candidate has a good grasp of the methods and there suitability, but there is a lack of detail. Straightforward ideas are expressed clearly. 5 -8 • Candidate shows detailed knowledge and understanding of the methods and will clearly explain the reasons why they are suitable, especially at the top end of the mark range. There will be a variety of examples to support points made. Complex ideas will be expressed clearly. 9 - 12	**12 marks**

08	With the aid of annotated sketches describe a system that would perform the sequence shown in **Figure 1.** **Figure 1**  **Marks awarded as follows:** Input / sensor (1 mark) Output device for audible warning (1 mark) Production of audible warning (1) 5 seconds (1) (2 marks) Prime mover (1 mark) Conversion to linear motion (1 mark) Linear movement (1) 300mm (1) High speed (1) (3 marks) Delay (1) 10 seconds (1) (2 marks) Return (1) 300mm (1) Slow (1) (2 marks) Repeat of sequence (1) (2 marks) Explanation of sequence limited (1) majority (2) Full (3) (3 marks) *(16 marks MAX)*	**16 marks**

09	With reference to specific systems or products, discuss the factors to be considered when deciding on suitable methods to use for joining metals. Answers should use examples and make reference to; Materials – forces – speed – other joints close by – distortion – accessibility – stress – position – use – permanent / temporary – future production processes – accuracy etc. **Marks awarded as follows:** • Basic information with evidence of only limited understanding or knowledge. There will probably be a lack of specific information. There will be inaccuracies and confusion. 0 -4 • Candidate shows some sound knowledge but there will be some lack of detail and reference to specifics. The candidate has a good grasp of the methods and there suitability, but there is a lack of detail. Straightforward ideas are expressed clearly. 5 -8 • Candidate shows detailed knowledge and understanding of the methods and will clearly explain the reasons why they are suitable, especially at the top end of the mark range. There will be a variety of examples to support points made. Complex ideas will be expressed clearly. 9 - 12	**12 marks**
10	With the aid of diagrams, describe how the output from a microcontroller can be used to produce bi-directional rotary movement to an accuracy of 0.1 of a degree. Answers should make reference to; The microcontroller outputs – Control inputs – Control process – control outputs – suitable prime mover- Bidirectional movement – conversion of movement – transmission – level of accuracy – feedback if required **Marks awarded as follows:** • Basic information with evidence of only simplistic understanding. Candidate will probably offer only a narrow range of obvious suggestions with few, if any, appropriate solutions to support points made, and possibly lack understanding of the concept. There will be many inaccuracies and confusion. 0 - 5 • Candidate shows some sound knowledge and understanding but there will be a lack of precise and accurate detail, at the lower end of the mark range. A number of relevant solutions for sub-systems will be given. There are likely to be some inaccuracies and misunderstandings,	

	especially at the lower end of the range. Straightforward ideas are expressed reasonably clearly. The majority of the system will function. 6 - 10 • Candidate shows detailed knowledge and understanding of a wide variety of issues and gives a wide range of relevant solutions to sub-systems. The information will be detailed and accurate. Complex ideas will be expressed clearly. For the highest marks the system should function at the required level of accuracy. 11 - 16	**16 marks**
11	With the aid of diagrams explain in detail how it is possible to monitor and display a temperature range of 0 - 60 degrees centigrade using a microcontroller. Answers should use examples and make reference to; **Marks awarded as follows:** <u>Input Stage:</u> Sensing and appropriate input Sensor (1) – Output (1) - Signal modification (1) (3 marks) <u>Process Stage:</u> Monitoring of input (1) continuous (1) (2 marks) Conversion to digital (1) (1 mark) Conversion for correct output (1 mark) Program/flowchart (1 mark) <u>Output Stage:</u> Output from microcontroller (1 mark) Suitable for 2 digits (1 mark) Decoding for display (1) (1 mark) Display components (1) (1 mark)	**12 marks**

12	With the aid of annotated sketches, describe in detail how the plastic component shown in **Figure 2** could be accurately fabricated from 10mm acrylic sheet. **Figure 2**  Your answer should make reference to: • Production of the separate pieces (3) • Suitable joining methods (1) • How the required level of accuracy is achieved (2) • The stages in the production process (3) • The processes, tools and equipment used. (3) **Marks awarded as follows:** Production of the separate pieces Marking out CAD or hand tools (1 mark) Cutting out (1 mark) Description of equipment used (1 mark) Suitable joining methods (1 mark) How the required level of accuracy is achieved Selection of suitable process (1) Selection of suitable processes (2) (2 marks) The stages in the production process Some (1) most (2) All (3) (3 marks) The processes, tools and equipment used. Some (1) most (2) All (3) (3 marks)	**12 marks**

13	With the aid of annotated sketches describe in detail how you the plastic component shown in figure2 could be mass produced using a deformation/redistribution process from a suitable variety of plastic (polymer). **Marks awarded as follows:** Selection of suitable process (1 mark) Selection of suitable plastic (1 mark) **<u>Manufacture of the mould/former</u>** Design (1) quantified (1) Fit for purpose (1) Marking out (1) Assembly (1) Explanation of Manufacture (5 marks) The processes, tools and equipment used. Some (1) most (2) All (3) (3 marks) **<u>Explanation of production process</u>** The stages in the production process Some (1) most (2) All (3) (3 marks) The processes, tools and equipment used. Some (1) most (2) All (3) (3 marks)	**16 marks**