

GCE 2005
January Series



Mark Scheme

Design and Technology: Systems and Control Technology *(Subject Code 5556)*

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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The answers given in the following mark scheme 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 and QUALIFICATIONS ALLIANCE**GENERAL CERTIFICATE OF EDUCATION****January Examination 2005****DESIGN AND TECHNOLOGY: SYSTEMS AND CONTROL TECHNOLOGY****UNIT 1 (SCT1)****Question 1**

- (a) Any three valid points for each of the two devices.

Full marks can only be gained by making reference to:

The sensing properties of the device.

(2 x 1 mark)

The resistance characteristics of the device.

(2 x 2 marks)

- (b) $V_{\text{out}} = (22000/(5000+22000)) \times 9$

(1 mark)

$$V_{\text{out}} = (22000/27000) \times 9$$

(1 mark)

$$V_{\text{out}} = 7.33\text{v}$$

(2 marks)

- (c) Any suitable circuit diagram (**or diagrams**) of a temperature switching circuit. E.g. Comparator, Transistor switching, Relay, PIC.

(10 marks)

Full marks can only be gained by the inclusion of:

The potential divider from part (b)

Component values/PIC programme that will switch outputs at the required temperature.

Quality of diagram.

(2 marks)

- (d) Any suitable plastic. E.g. Polystyrene, ABS etc.

(1 mark)

Any two comments discussed in depth of the working properties of the chosen plastic.

(4 marks)

- (e) Suitable annotated sketch(es) and explanation of a suitable process.

E.g. Vacuum Forming, Injection moulding, **line bending, laser cutting**:

Description of chosen process.

(Up to 5 marks)

Quality of sketch(es).

(2 marks)

- (f) Any three valid comments, with discussion, comparing and/or contrasting the two systems. (6 marks)

E.g.

Quality control is a method of checking quality against set standards.

Quality control occurs after a particular stage in manufacture.

Quality control is undertaken by trained inspectors.

Quality assurance is a series of planned actions to ensure a product meets given quality standards.

Quality assurance takes place at all stages of manufacture.

Quality assurance is the responsibility of all personnel involved in the design and manufacture of a given product.

Total 40 marks

Question 2

- (a) Suitable annotated sketches and discussion of operation of two types of braking system. E.g. Rim, disc, band, drum, magnetic, regenerative brakes etc. (2 x 4 marks)

Quality of sketches. (2 x 1 mark)

- (b) Any two situations, with discussion where frictional forces are undesirable. (2 x 3 marks)

E.g. Rotating parts, Pistons, Crank and Slider.

Full marks can only be gained by making reference to suitable ways of reducing the frictional forces.

- (c) $18\text{N} \times 50\text{mm} = \text{Effort} \times 180\text{mm}$ (1 mark)
Effort = $900/180$ (1 mark)
Effort = 5N (2 marks)

- (d) Any two points, with discussion, of pollution issues related to motor cars and pedal cycles. (2 x 4 marks)

E.g. Noise pollution, use of fossil fuels in the use of motor cars, manufacturing industry pollution.

Total 28 marks

Question 3

- (a) Any suitable input sensor for use in the given application. (3 marks)
E.g. induction loop, pressure switch **Ultrasound, Infrared** etc.
Quality of sketch. (1 mark)
- (b) Any suitable method of automatically controlling the two lights. (6 marks)
E.g. Flip-Flop, PIC with suitable programme.
Quality of circuit diagram. (1 mark)
Use of correct symbols. (1 mark)
- (c) Any valid responses comparing the two output devices. (8 marks)
E.g.
Light bulbs require higher voltages to drive them than LEDs.
LEDs require much smaller currents to drive them than light bulbs.
The viewing angle of an LED is much smaller than that of a light bulb.
The average life of an LED is much greater than that of a light bulb.
- (d) $R_p = (V_{\text{supply}} - V_{\text{LED}})/I_{\text{LED}}$ (1 mark)
 $R_p = (12 - 2)/0.02$ (1 mark)
 $R_p = 10/0.02 = 500\Omega$ (2 marks)
- (e) Any **four** points briefly made, or **two** points with discussion on the suitability of the material in this application. (4 marks)
E.g.
Aluminium is highly resistant to corrosion.
Aluminium is malleable, therefore is easy to bend into shape.
Aluminium is difficult to weld, therefore difficult to fabricate certain shapes.
Aluminium is more expensive compared to steel or plastics.

Total 28 marks

Question 4

- (a) (i) Any valid definition. Answers should make reference to the timber being natural and from generally evergreen trees. (2 marks)
Any valid example. E.g. Pine, Spruce, Deal etc. (1 mark)
- (ii) Any valid definition. Answers should make reference to the plastic being heated once before setting then being resistant to softening by further heat. (2 marks)
Any valid example. E.g. Melamine Formaldehyde, Polyester etc. (1 mark)
- (b) Any three valid points with explanation for each of the two surface finishes.

Full marks can only be gained by making reference to:
A specific surface finish for each material. (2 x 1 mark)
A suitable method of application of the selected finish (2 x 1 mark)
The characteristics and reasons for choice of the finish. (2 x 3 marks)

- (c) Simplistic answer giving basic information about the recycling opportunities for the three groups of materials. (3 x 1 – 2 marks)

Good answer giving detailed information and specific examples for the recycling opportunities of the three groups of materials. (3 x 3 – 4 marks)

E.g.

Wood can be recycled and chipped before adding to new timber in the production of chipboard and MDF.
Wood pulp in the form of paper can be recycled to reduce deforestation.

Many metals can be collected and recycled to reduce dependence on naturally occurring ores.
Aluminium cans can be collected and recycled generating income for communities or charities.

Many plastics can be collected and recycled but there are problems separating different types of plastic.
Polypropylene can be recycled from plastic bottles to make clothing.

Total 28 marks

TOTAL MARKS ON PAPER 124
QWC 4 MARKS = 128