UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

0445 DESIGN AND TECHNOLOGY

0445/04 Paper 4 (Systems and Control), maximum raw mark 50

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Section A

Answer **all** questions in this section.

1 Frameworks are one type of structure.

(a) (i) Pylon / bridge / etc. [1]

(ii) Skeleton / tree / spider web / etc. [1]

(b) Shell [1]

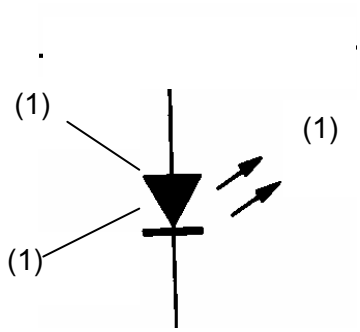
2 **(a)** A strain gauge senses changes in **<u>length</u>** [1]

(b) Deflection in beams / strain on structural members [1]

3 Copper wire – conductor (1)
PVC sheath – insulator (1) [2]

4 The length 'X' of the handle (1) acting at 90° to the shaft gives increased leverage (1) [2]

5



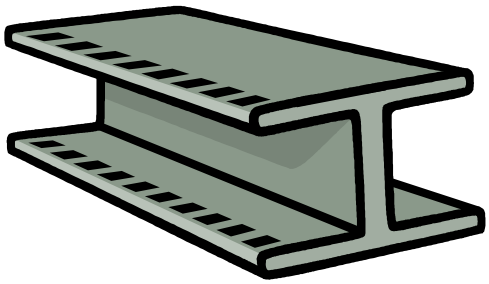
[3]

6 **(a)** Hand drill / egg whisk / food mixer / etc. [1]

(b) Rotary motion in one direction (1) is converted to rotary motion at 90° to input (1) [2]

7 Climate control in glasshouse / washing machine / traffic lights / etc. [1]

8 **(a)** Sketch the cross section of an 'I' section beam.



'I' shape (1)
Quality of sketch (1)

[2]

(b) Good strength to weight ratio (1). Effective use of materials target the areas of maximum force applied to the outer edges of a beam (1) [2]

9 DTI / Dial test indicator / dial gauge [1]

10 **Voltage**: The amount of electricity (1) available. The amount of electricity needed to power a component / circuit (1) [2]

Current: The speed at which electricity flows through a circuit (1). The strength of the electricity needed to power a device / circuit (1) [2]

Section B

Answer **one** question from this section.

11 **(a)** Switch allows current to flow (1)
This energises the 555 (1)
The speaker sounds due to the astable nature of the 555 (1)
The alarm sounds until the input is disconnected (1) [4]

(b) All correct (2)
Half correct or wrong way round (1) [2]

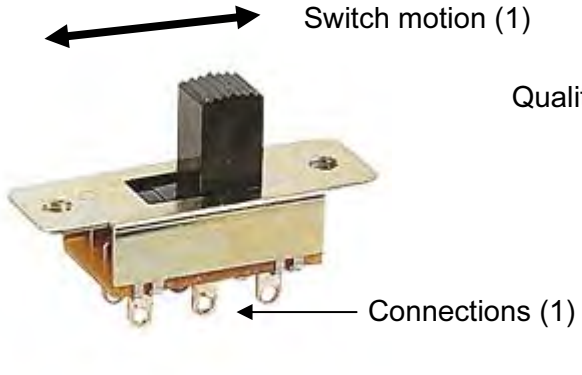
(c) Electrolytic capacitors have polarity (1), ceramic capacitors do not (1) and can be connected anyway round (1) [3]

(d) Allows the frequency (1) of the audio sound output to be adjusted (1) [2]

(e) Six [1]

(f) Chemical (1) to Electrical (1) [2]

(g) (i)

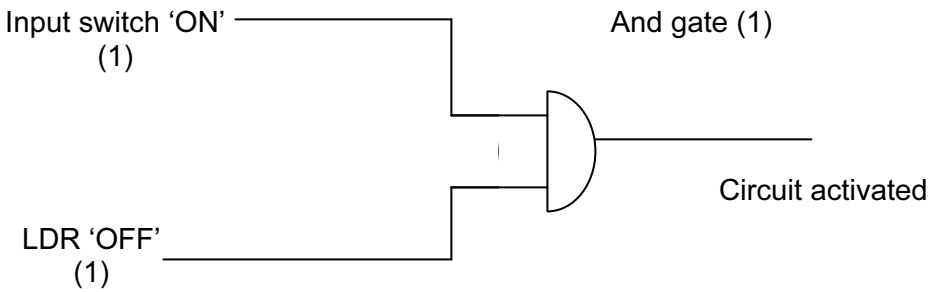


[3]

(ii) O------ (1)
-----O---
O------ (1) [2]

(iii) By substituting the slide switch with a membrane switch (1) so that when someone steps on it (1) the circuit is activated (1) [3]

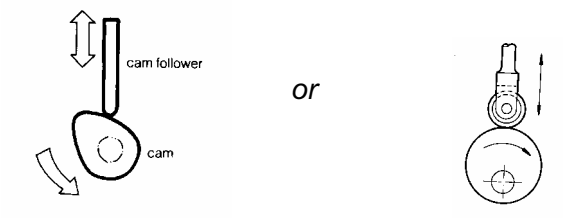
(h)



[3]

12 (a) Rotary [1]
Reciprocating [1]

(b) Sketch (1) + direction of motion arrows 2 × (1)



[3]

(c) **(i)** As the cam moves round the follower gradually rises (1) until the follower rea… the drop edge when it suddenly moves down (1). The motion can only move … one direction due to the shape of the cam (1) [m…]

(ii) Diagram shows correct direction of rotation [1]

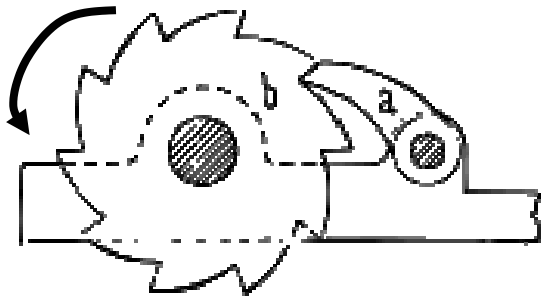
(d)

Method	Benefit	Drawback	Example of use
Chains and Sprockets	Reduced slip / low cost / (1)	Chain stretch / Noise / Links break (1)	Bicycle / Motor bike / Lawn mower (1)
Pulleys and Belts	Low cost / easy to maintain (1)	Belt wear / slip / (1)	Drilling machine / Conveyer system / Plotter (1)
Gears	Compact / positive drive / (1)	High cost / maintenance / (1)	Motor car / hand drill / fishing reel (1)

[9]

(e) **(i)**

(c)



(a) Pawl, (1)
(b) Ratchet, (1)
(c) Motion, (1)
+ Quality (1)

[4]

(ii) Fishing reel / hoists / spanners / turnstiles (1) [1]

(f) VR = No. teeth on driven gear / No. teeth on driver (1)
VR = 56 / 14 (1)
VR = 4 (1) [3]

13 **(a)** By folding (1) the material it becomes more rigid (1) [2]

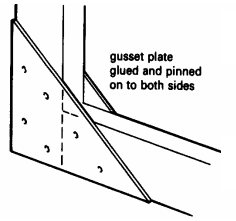
(b) **(i)** Give *three* benefits of this type of door construction.
1 Reduced weight for same strength (1)
2 Reduced materials cost (1)
3 Ecologically friendly (1) [3]

(ii) Aircraft wings [1]

(c) Ribs for rigidity, curled edge for rigidity, shell structure lightweight

(d) **(i)** The brace (1) helps to reduce the buckling (1) of the members due to external loading (1) [3]

(ii)



Notes (1)

Diagram (1)

Quality of response (1)

[3]

(iii) Easy to fit / low cost / increased rigidity [1]

(e) **(i)**

Member	Type of forces experienced	Failure
Cable	Tension	Snapping (1)
Column	Compression (1)	Buckling
Deck	Bending (1)	Bending (1)

[4]

(ii) Dynamic [1]

(iii) Shear [1]

(iv) Load is spread (1) across a larger area (1) thus reducing the effect of the load (1) [3]