UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

0445 DESIGN AND TECHNOLOGY

0445/42   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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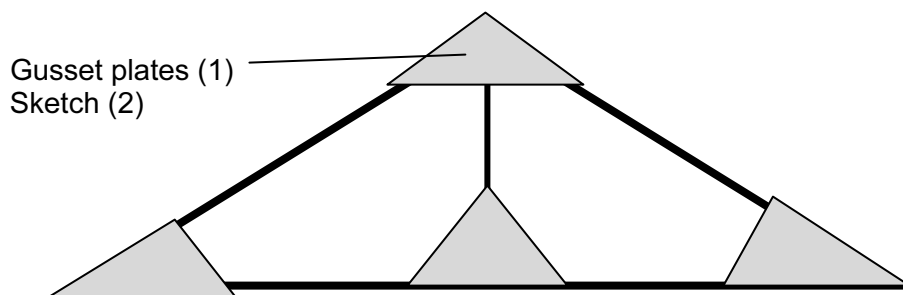
Section A
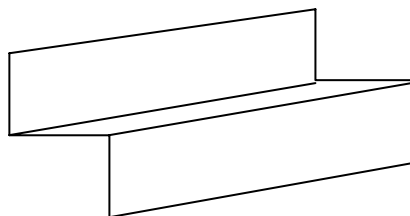
Answer **all** questions from this section.

1

Force	Type of force	Example
Tension	**Stretching** [1]	Cable on a suspension bridge
Compression	Squashing or crushing	**Column in building** [1]
Torsion [1]	Twisting	**Drive shaft in engine** [1]

2

Gusset plates (1)
Sketch (2)

[3]

3 Folds increase rigidity (1)
Sketch (2)

[3]

4

Source	Energy conversion	Example of use
Dry cell battery	**Chemical to electrical** [1]	**Portable radio** [1]
Solar cell	Light into electrical	**Solar powered calculator** [1]
Dynamo	**Mechanical to electrical** [1]	Bicycle lamp

5 Transistor   [1]

6 The reed contacts are brought together by a magnet (1) passing by them which com[pletes] circuit (1)

7 e.g. Washing machine control [1]

8

| Type of motion	Description	Example of use
Linear	Moving in a straight line	**Lift doors** [1]
Rotary	**Moving in a circular path** [1]	Drilling machine
Reciprocating [1]	Moving back and forth in a straight line	Jig saw blade
Oscillating	Swinging back and forth in an arc	**Pendulum** [1]

9 (a) Third [1]

(b) e.g. Tongs [1]

10 e.g. Printer head [1]

Section B

Answer **one** question from this section.

11 (a) (i)

Spring (1)

Pawl (1)

Direction of free rotation (1)

Ratchet (1)
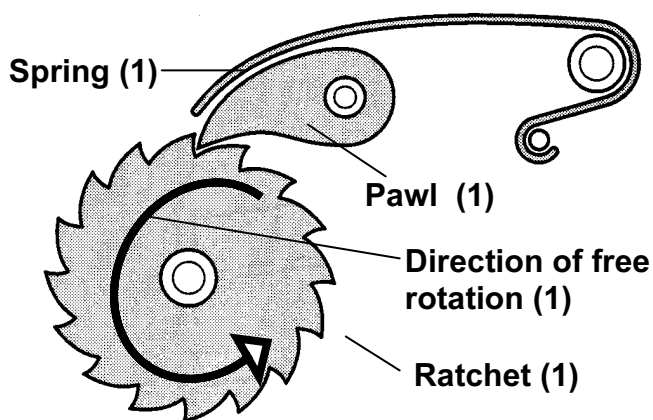
[4]

   (ii) e.g. Winch; fishing reel [1]

   (iii) Disengage the pawl (1) by pushing it out sideways (1). [2]

(b) Rotary (1) to linear (1) [2]

(c) There is no slip (1) due to the positive engagement of the chain and sprocket wheel (1) [2]

(d) (i) VR = Teeth on driven / Teeth on driver (1)
VR = 36 / 18 (1)
VR = 2 (1) [3]

   (ii) Speed of driver / speed of driven = VR (1)
Speed of driver / VR = speed of driven
200 / 2 = speed of driven = 100 rpm (1) [2]

   (iii) MA = VR × Efficiency (1)
MA = 2 × 60 /100 (1)
MA = 1.2 (1) [3]

(e) (i)

Shaft (1)
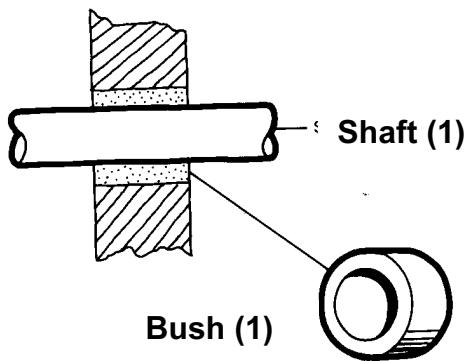
Quality of diagram (1)

**Bush (1)** [3]

(ii) Bicycle: pram wheel [1]

(iii) Metal to metal contact is reduced (1) by introducing a layer of lubricant (1) [2]

12 (a)
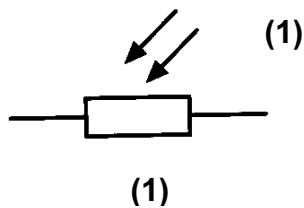
Transducer	Environmental change sensed	Example of use
LDR	**Light** [1]	**Burglar alarm** [1]
Thermistor [1]	Temperature	Frost alarm
Strain gauge	Length of a structural member	**Measure strain in a joist** [1]

(b) (i)

Light sensitive cell (1)

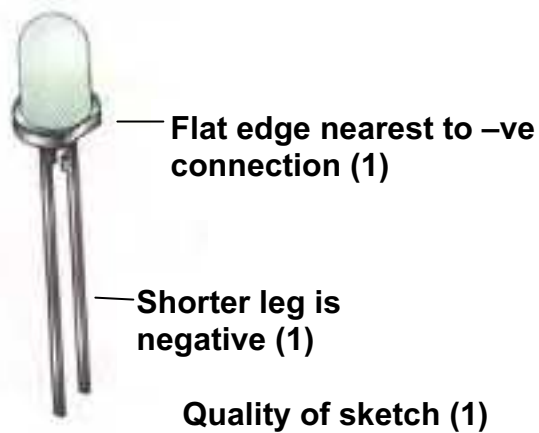Connecting wires (1)

Quality of sketch (1)

[3]

(ii)

(1)

(1)
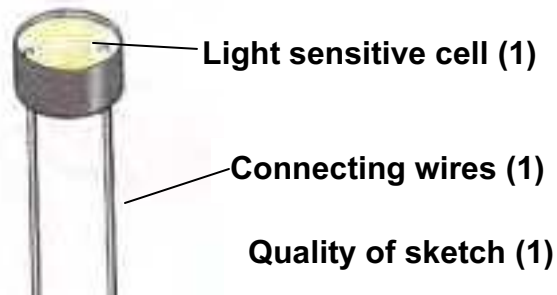
[2]

(c) (i) Sketch and label an LED component to show the positive and negative connections and how these connections are identifiable.

Flat edge nearest to –ve connection (1)

Shorter leg is negative (1)

Quality of sketch (1)

[3]

(ii) An LED must be protected (1) from excessive current (1) [2]

(iii) On / off indicator lamp on electrical appliance. [1]

(d) (i) V = I.R
9 = .02 . R (1)
R = 9 / .02 (1)
R = 450 Ω (1) [3]

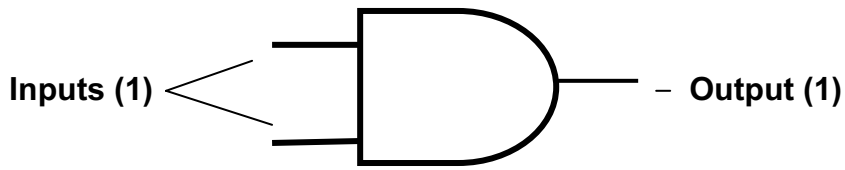**(ii)** 1st: Yellow [1]
2nd: Violet (allow Green) [1]
3rd: Brown [1]

(e) (i) AND

(ii)

Inputs (1) Output (1)

Shape (1) [3]

13

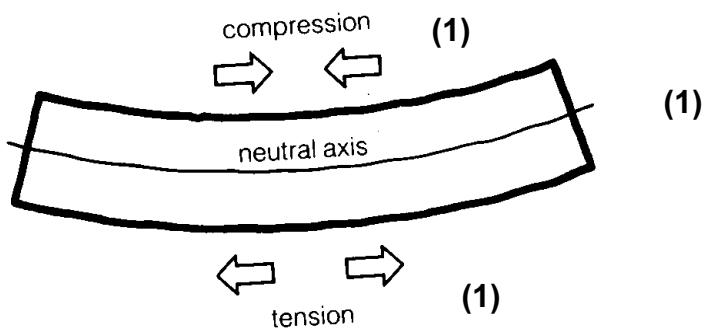| Number	Name
1	Strut
2	Tie
3	Cantilever
4	(Simply supported) beam

[4]

(b) Increases the rigidity (1) and limits the tendency to buckle (1). [2]

(c) (i) It is a rigid section that supports the load (1) but is lightweight (1). [2]
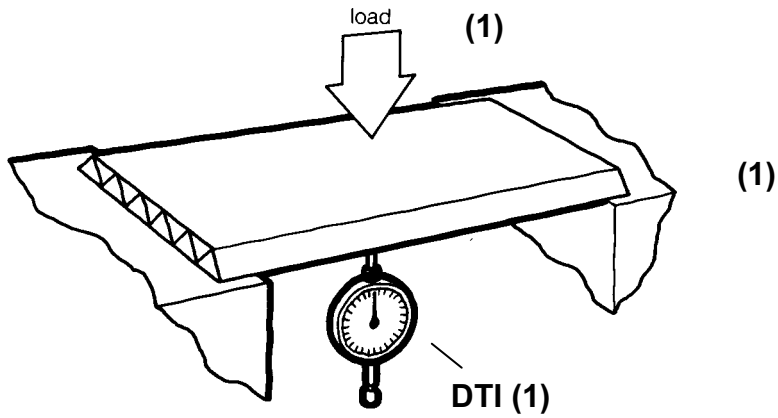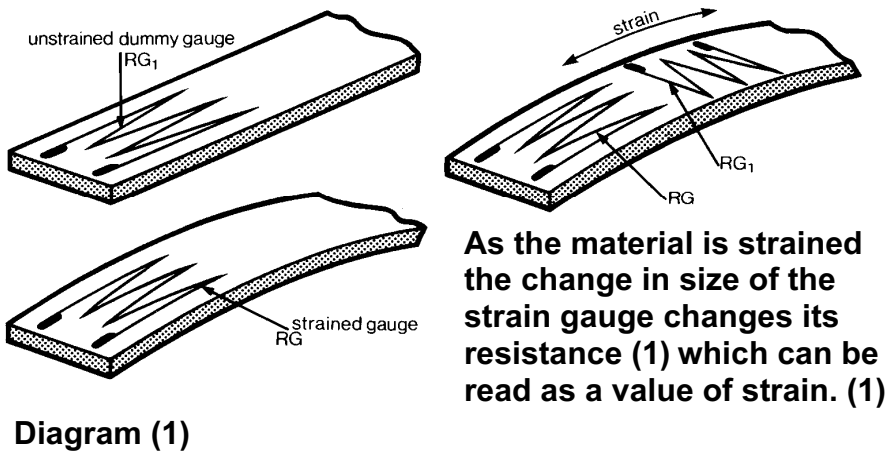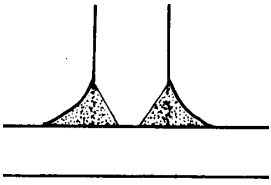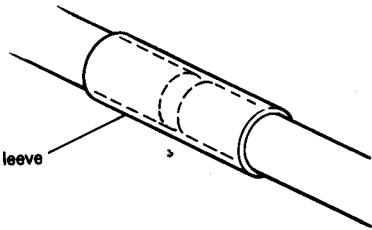
(ii)

compression **(1)**

(1)

neutral axis

tension **(1)**

[3]

(d)

load **(1)**

(1)

DTI **(1)**

[3]

(e)

unstrained dummy gauge
RG$_1$

strain

RG$_1$

RG

strained gauge
RG

As the material is strained the change in size of the strain gauge changes its resistance (1) which can be read as a value of strain. (1)
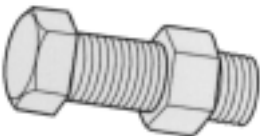
Diagram (1)

[3]

(f) (i)

Joining method	Diagram	Use
Welding	[2]	Framework for a building. [1]
Sleeving [1]	leeve	Joining tent poles.
Nuts and bolts		'Dexion' shelving [1]

(ii) To distribute the load (1) over a wider area (1) thus reducing the stress on the component (1).   [3]