UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

0445 DESIGN AND TECHNOLOGY

0445/42 Paper 42 (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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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UNIVERSITY *of* CAMBRIDGE
International Examinations

Section A

1   Input: Rotary (CW)   [1]
    Output: Reciprocating   [1]

2   **(a)** Eccentric   [1]

    (b) Follower   [1]

3

Method	Example of use
Spur gears	**Lathe gear box (1)**
Bevel gears	**Hand drill (1)**
Rack and pinion	**Car steering system (1)**

[3]

4   Reduce friction/wear and tear/smooth running   [1]

5   **(a)** **(i)** Crane tower/building framework/pylons   [1]

         (ii) Tanker/boat hull/car body   [1]

    (b) **(i)** Tension   [1]

         (ii) Force x perpendicular distance from pivot   [2]

6   Increases rigidity (1) and ability to withstand buckling (1)   [2]
    Distribution of loading (1)

7   Strain gauge/Dial gauge   [1]

8

Meter	Units measured	Example of use
Ammeter	**AMPS (1)**	Measure current flowing through a transistor.
Voltmeter	Volts	**Measure voltage across a potential divider. (1)**
Multi-meter (1)	**OHMS (1)**	Check the continuity of an electrical lead.

[4]

9 (a) LDR (Light dependant resistor) [1]

(b) Protects (1) the Transistor from back EMF (1) created by the coil of the relay. [2]
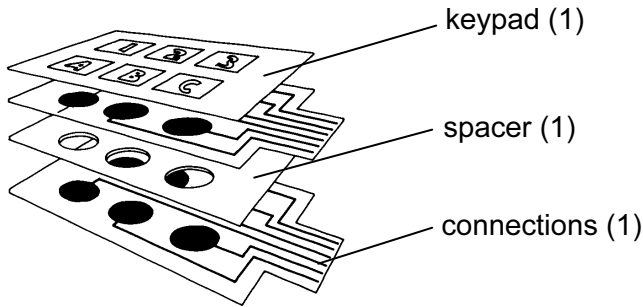
10
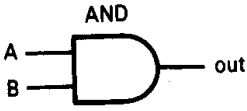
[2]

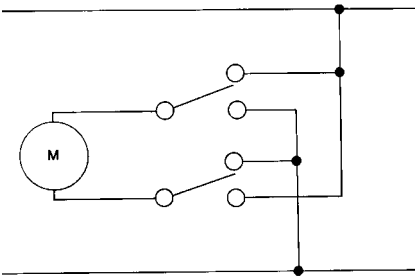**[Total: 25]**

Section B

11 (a) (i) Reed switch [1]

(ii) A burglar alarm (1) on a bicycle that is activated when the bike is moved (1). [2]

(iii)

keypad (1)

spacer (1)

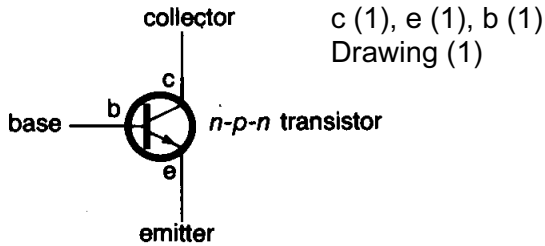connections (1)

[3]

(b)

Appropriate example (1)
Circuit works (1)
Correctly drawn to convention (1)

[3]

(c) (i) A small current flowing at the base (1) enables a large current (1) to flow through collector/emitter circuit (1). [3]

(ii)

c (1), e (1), b (1)
Drawing (1)

n-p-n transistor

[4]

(d) Clamp a heat sink (1) to leg that is being soldered (1) [2]

(e) Burglar alarm system/washing machine controller [1]

(f) (i) OR [1]
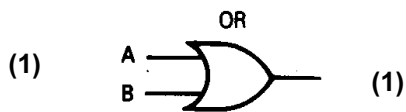
(ii)

A	B	Q
0	0 (1)	0
0	1	1 (1)
1	0	1
1	1 (1)	1

[3]

(iii)

OR

(1)

(1)

[2]

12 (a)

Pulley System	Input	Output Direction	Output Speed
A	Clockwise	**Anticlockwise (1)**	Increased
B	Clockwise	**Clockwise (1)**	Increased
C	**Anticlockwise (1)**	Clockwise	**Decreased (1)**

[4]

(b) speed of driven = $\dfrac{\text{speed driver} \times \text{Ø of driver}}{\text{Ø of driven}}$ (1)

speed of driven = $\dfrac{1000 \text{ rpm} \times 90 \text{ mm}}{30 \text{ mm}}$ (1)

speed of driven = 3000 rpm   (1)   [3]

(c) **(i)** Record player turntable/vacuum cleaner/sewing machine   [1]

  (ii) Wedge into their pulley wheels (1) to avoid slipping (1)   [2]

  (iii) Pillar drill/lathe/car engine fan belt   [1]

(d) **(i)** Velocity Ratio = $\dfrac{\text{Teeth on driver gear}}{\text{Teeth on the driven gear}}$ (1)
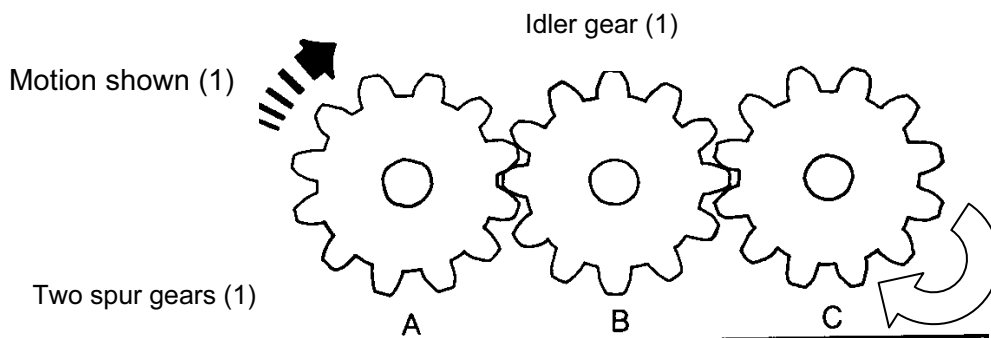 VR = 12 / 24   (1)

  VR = 1 : 2   (1)   [3]
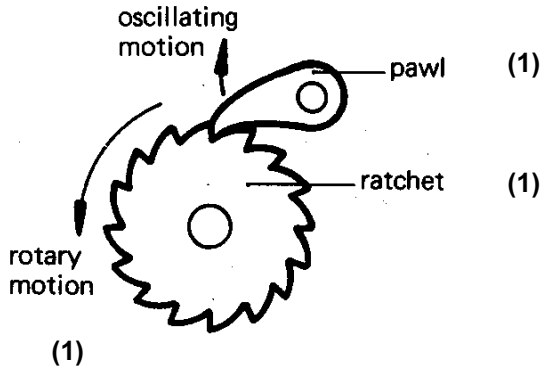
  (ii) Decreased   [1]

  (iii)

Motion shown (1)

Idler gear (1)

Two spur gears (1)

A   B   C

Accept schematic version

[3]

(e) (i) Winch/fishing reel [1]

(ii) Makes a shaft can rotate (1) in one direction only (1). [2]
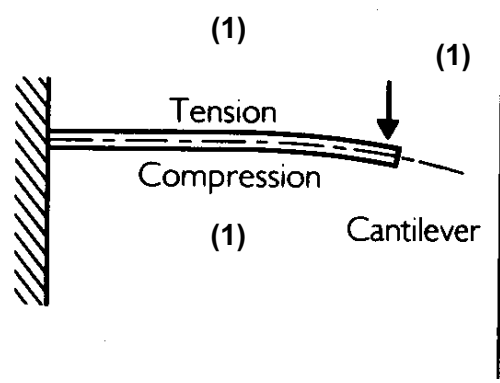
(iii)
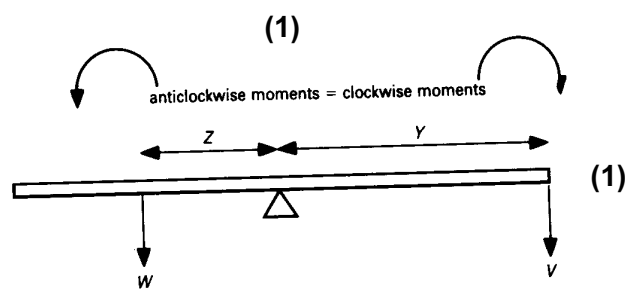

oscillating motion

pawl **(1)**

ratchet **(1)**

rotary motion

(1)

[3]

[Total: 25]

13 (a) Cantilever [1]

(b)

(1)

(1)

Tension

Compression

Cantilever

(1)

[3]

(c)

(1)

anticlockwise moments = clockwise moments

Z

Y

(1)

W

V

weight *W* × distance *Z* = weight *V* × distance *Y* (1) [3]

(d) Reaction at the wall = Force × distance from the wall (1)
Reaction at the wall = 12 N × 600 mm (1)
Reaction at the wall = 7.2 Nm (1)   [3]

(e) Tubing has a good strength to weight ratio (1). It will support a load without placing too much load on the wall due to its own weight (1).   [2]

(f) **(i)** To distribute the load across a larger area (1) thus minimising the risk of a single fixing failure (1).   [2]

   (ii) Torsion   [1]

   (iii) The screw could shear (1) through its shaft (1)/or the screwhead could break off (1).   [2]

(g) **(i)** Increased rigidity of the frame (1) and thus more stability (1).   [2]

   (ii) Prevents the legs of the steps from splaying (1) thus making the steps safer and more robust (1).   [2]

   (iii) Increases the rigidity (1) and the capability to bear bending loads (1).   [2]

   (iv) Use notes and sketches to show the effect of loading on one of the stepladder treads.

                                    [2]

                                    [Total: 25]