UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2007 question paper

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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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

Answer **all** questions in this section.

1 Distance [1]

2 Electrical (1) Heat (1) [2]

3 **(a)** Car body [1]

(b) Animal skeleton [1]

4 Shovel / Fishing rod [1]

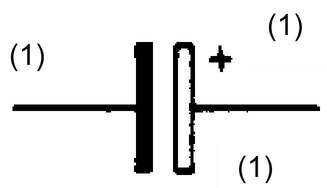
5 **(a)** Rotary (1) to Linear (1) [2]

(b) Any suitable example [1]

6 **(a)** Orange (1) Orange (1) Brown (1) [3]

(b) Accuracy (1) ***or*** tolerance (1) e.g. ± 5 % (1) [2]

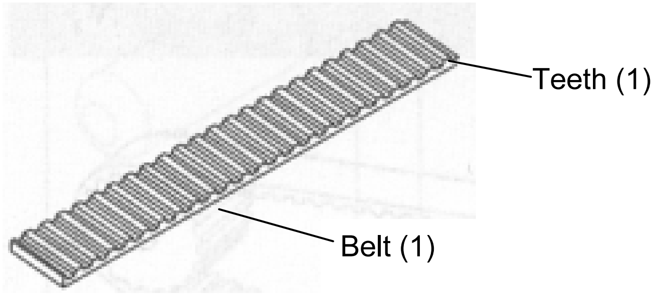
7



[3]

8 A member (1) that experiences compressive load (1) [2]

9 **(a)**



[2]

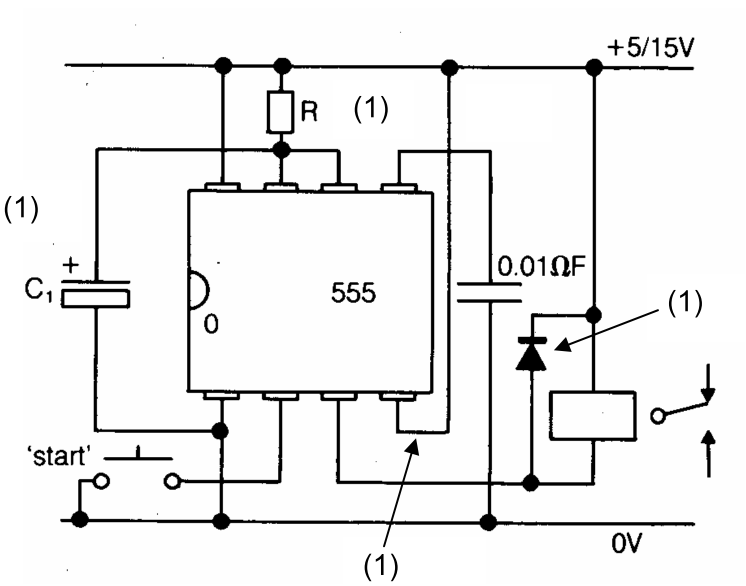
(b) Timing belt [1]

(c) No slip (1) thus more efficient (1) [2]

10 Thermistor [1]

Section B

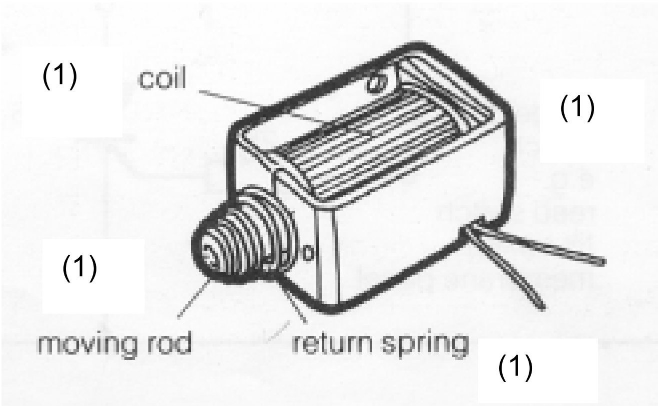
11 **(a)**



[4]

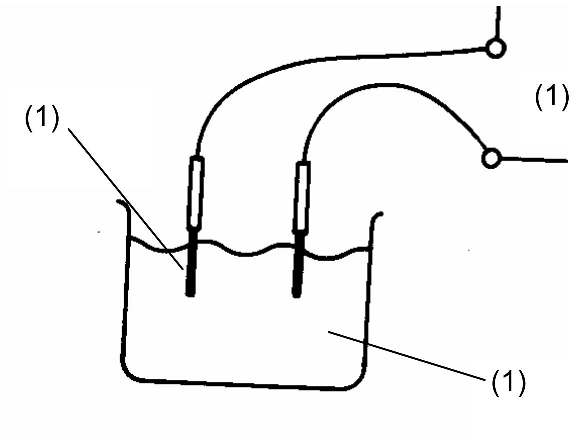
(b) Interface (1) between two circuits of differing current rating (1).
Control of large current by small current device (1). [3]

(c)



[4]

(d)

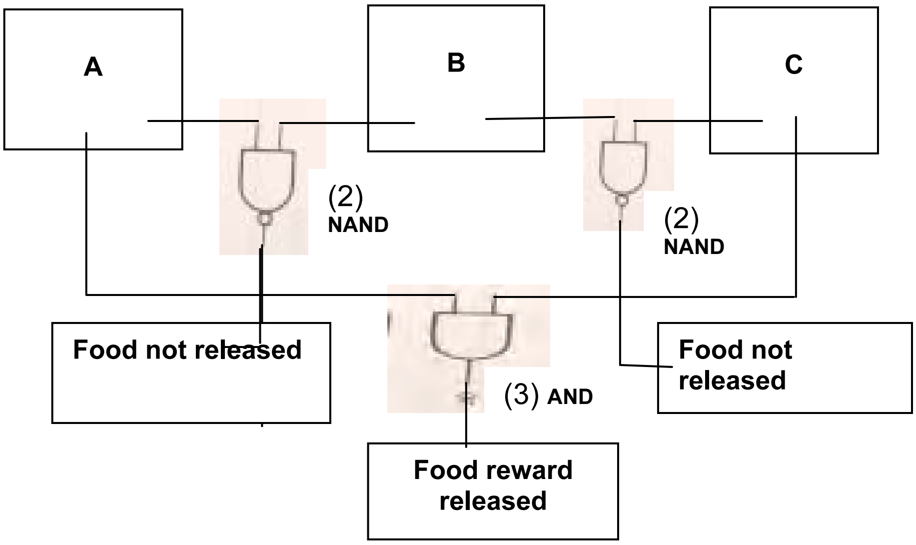


[3]

(e) **(i)** Adjusts the sensitivity of the circuit (1) by varying its resistance (1) and thus the bias voltage and base current flowing (1). [2]

(ii) A clamping diode is used to reduce the possibility of damage to the I C (1) from back emf (1) generated by the relay coil (1). [2]

(f)



[7]

12 **(a)** This section is more rigid (1) and will withstand more compressive force (1). At the same time it is more materials cost efficient (1). [3]

(b) **1** Frame construction (1) plus example (1) [2]
2 Shell construction (1) plus example (1) [2]

(c) No bracing (1)
Diagram showing cross bracing (2)
Appropriate labelling (1) [4]

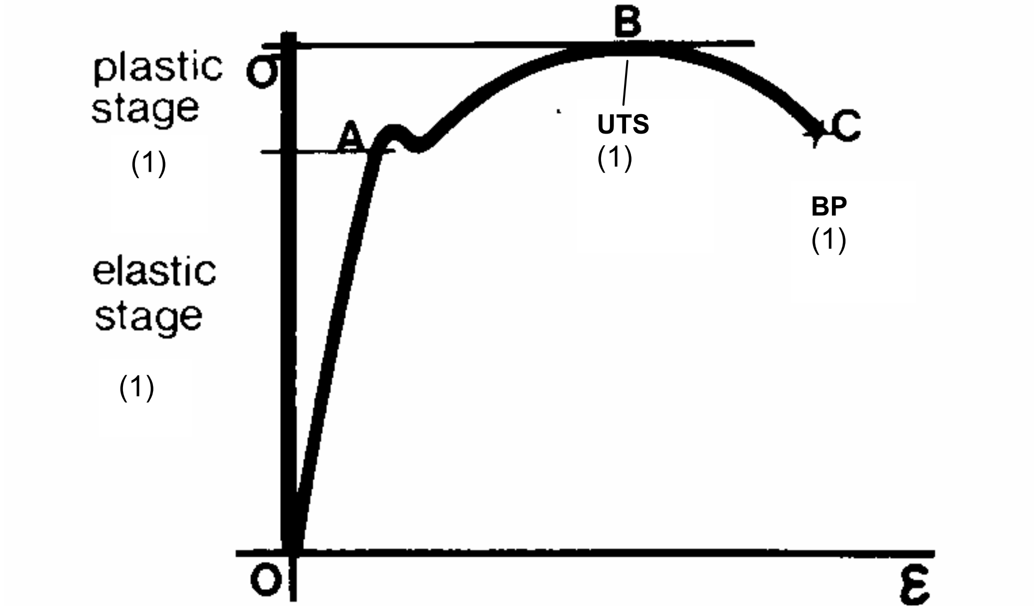
(d) Clear diagram showing the cutting effect of shear force (2)
Appropriate label (1) [3]

(e) **(i)** This increases the rigidity (1) of the casing at its edges thus reducing the chances of buckling (1) or failure under load (1). [2]

(ii) Help to evenly distribute the stresses (1) in the casing thus reducing the chances of stress fracture (1) or stress build up (1). [2]

(iii) DTI gauge [1]

(f) **(i)**



[3]

(ii) Strain = change in length / original length
Strain = 0.01 mm / 1000 mm (1)
Strain = 0.00001 (1) or 1 x 10^{-5}
Units (1) [3]

13 **(a)** Shovel [1]
Digger bucket and arm [1]

(b) **(i)** Second order [1]

(ii) Load [1]

(iii) Fulcrum [1]

(c) **(i)** E × 1000 mm = 1200 N × 350 mm (1)
E = 420000 Nmm / 1000 mm (1)
E = 420 N (1) [3]

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

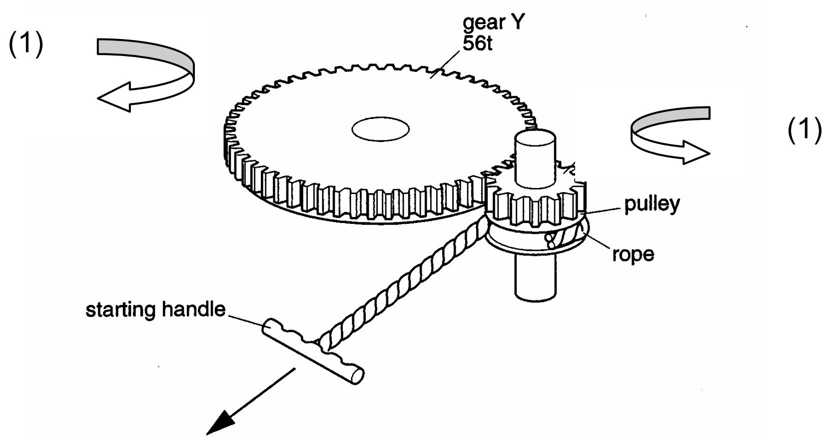
(d) (i) 4 (Equal to number of pulleys) [1]

(ii) MA = Load / Effort (1)
4 = Load / 850 N (1)
4 × 850 N = Load = 3.4 KN (1) [3]

(iii) It takes a long time (1) to move the load a small distance (1) and a lot of rope or chain is needed (1) [2]

(e) Fig.10 shows part of the starting system for a cement mixer.

(i)



[2]

(ii) X Driver [1]
Y Driven [1]

(iii) VR = Teeth on driven / teeth on driver (1)
VR = 56 / 14 (1)
VR = 4 : 1 (1) [3]

(f) (i) Gives the user greater MA (1) thus makes the effort needed less (1) and the handle easier to turn (1) [2]