



Complete, fold and seal
(see note 2 below)

SURNAME: FRANKLIN

FORENAME(S): Jack

Examination Answer Books

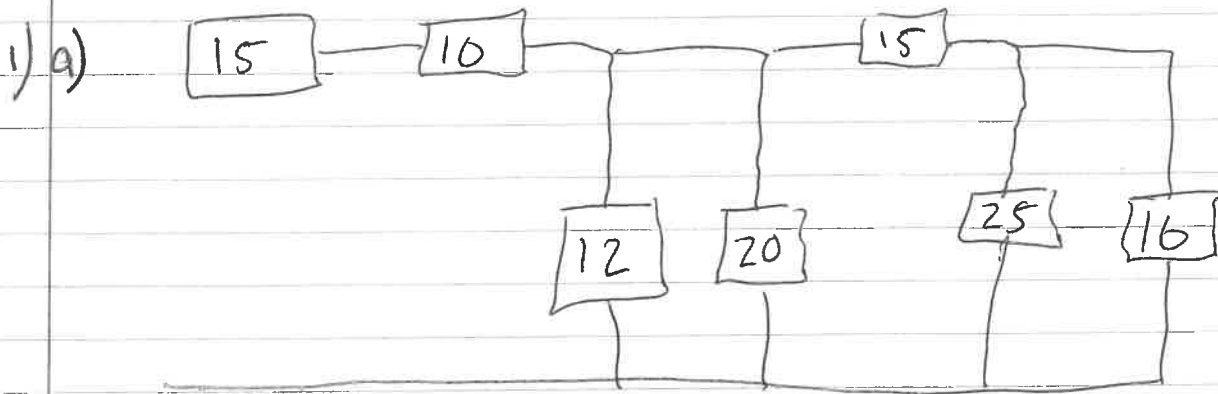
12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

1	Student Number	2117899
2	Title of Examination Paper	Engineering Science.
3	Module Code	PCPO4001
4	Date and Time of Examination	11 th MAY 22 12:00
5	Examination Venue	Pembrokeshire College.
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1a	9
1b	
2A	8
2b	
3A	16
3b	
4A	
4b	8
4c	
5A	
5b	0
Total	41



equivalent resistance

$$\frac{1}{16} + \frac{1}{25} = \frac{1}{ans} = 9.76$$

$$9.76 + 15 = 24.76$$

$$\frac{1}{24.76} + \frac{1}{20} = \frac{1}{ans} = 11.06$$

$$\frac{1}{11.06} + \frac{1}{12} = \frac{1}{ans} = 5.76$$

$$5.76 + 10 + 15 = \underline{30.76 \Omega}$$

5



i) $15nF + 80nF = 95nF$

$$220nF + 35pF + 95nF$$

1

$$\frac{1}{220 \times 10^{-6}} + \frac{1}{35 \times 10^{-12}} + \frac{1}{95 \times 10^{-6}} = 28.57 \times 10^9$$

$$= 28.57 nF$$

ii) Total charge = $28.57 \times 10^9 \times 12$

$$Q = CV = 342.84 \times 10^{-9}$$

2

iii) Total energy = $\frac{28.57 \times 10^9 \times 12^2}{2} = 2.06 \times 10^{-6}$

$$E = \frac{CV^2}{2} = 2.06 nJ$$

9

- 2) a) Radius 0.25mm 0.25×10^{-6} mm to M = $\times 10^{-6}$
 Length 6.2m
 Resistance 24Ω

Same wire 5 times longer - new length
 31m

Radius 2 times = $0.5 \times 10^{-6}\text{m}$

$$R = \frac{PL}{A} = \frac{31}{0.79 \times 10^{-6}} = 39.24\Omega$$

$$\text{Area} = \pi r^2 = \pi (0.5 \times 10^{-6})^2 = 0.79$$

$$R = \frac{PL}{A} = \frac{31\text{m}}{0.79 \times 10^{-6}\text{m}} = 39240506.33$$

$$= 39.24\text{M}\Omega$$

$$\text{b) } R = R_0(1 + \alpha \theta)$$

Resistance of 100Ω at 0°C
 ? at 40°C

temp - coefficient = 0.00392

$$100(1 + (40 \times 0.00392))$$

$$= 101.568\Omega ?$$

3) a) $h_o = 7\text{cm}$ $h_i?$
 $d_o = 40\text{cm}$ $d_i?$
 $f = 20\text{cm}$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{20} - \frac{1}{40} = \frac{1}{40} \text{ cm}$$

5

$$h_i = h_o + \left(-\frac{d_i}{d_o}\right) = 7 + \left(-\frac{40}{40}\right) = 6\text{cm}$$

4

$$d_i = 40\text{cm}$$

$$h_i = 6\text{cm}$$

b) $d_i?$ $h_o = 5$
 $h_i?$ $d_o = 30.5$
 $f = -15.2$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{-15.2} - \frac{1}{30.5} = -10.14\text{cm}$$

5

$$h_i = h_o + \left(-\frac{d_i}{d_o}\right) = 5 + \left(-\frac{-10.14}{30.5}\right) = 5.33\text{cm}$$

2

$$d_i = -10.14\text{cm}$$

$$h_i = 5.33\text{cm}$$

x

✓✓✓

Converging lens + 

4) a) ~~18~~ $d_o = 18 \text{ cm}$
 $f = 38$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{38} - \frac{1}{18} = -34.2 \checkmark$$

Virtual Image.

5

b) Glass-Water angle 48°

glass 1.50 Water 1.33

$$n_i \sin \theta_i = n \sin \theta_r$$

$$1.50 \sin 48^\circ = 1.33 \sin \theta_r$$

$$\text{angle of refraction} = -115.24^\circ$$

2

c) $h_o = 4$
 $d_o = 25$ calculate $= h_i$
 $f = 35 \text{ cm}$

$$\text{Find } d_i \text{ first } \frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{35} - \frac{1}{25} = -87.5$$

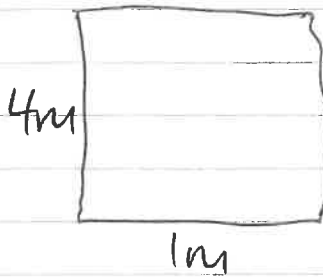
1

$$h_i = h_o + \left(-\frac{d_i}{d_o} \right) = 4 + \left(-\frac{-87.5}{25} \right) = 7.5 \text{ cm}$$

height of image = 7.5 cm.

8

5



In brick = 120 mm thick

fire brick = 180 mm thick

plaster = 220 mm thick

1.6 W/m

0.3 W/m

0.14 W/m

inner temp of wall is 1100°C

outer plaster is 50°C

For

Total Thermal resistance R_0

Total Heat transfer

Total Thickness = 520 mm

Heat lost = ~~1000~~ 1050°

$$b) Q - W = (T_2 - T_1)$$

Total work done = 2.04.

$$Q = W + (T_2 - T_1)$$

$$Q = 2.04 + 1050 = 1052.4$$

$$a) Q = m \times L H$$

$$= 520 \text{ mm} \times 50 = 26000$$