



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.**

Complete, fold and seal
(see note 2 below)

SURNAME: woolner

FORENAME(S): Samuel Charles

1	Student Number	<u>W00K5823701</u>
2	Title of Examination Paper	<u>Electrical power</u>
3	Module Code	<u>G0EEB000</u>
4	Date and Time of Examination	<u>17/5/22</u>
5	Examination Venue	<u>Gower college</u> <u>Swansea</u>
6	Seat Number	

7	Number of Answer Books handed in	<u>1</u>
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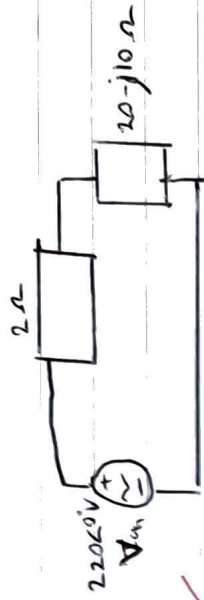
List the numbers of the questions you have attempted	Office Use
<u>1</u>	
<u>2</u>	
<u>3</u>	
<u>4</u>	
<u>Q1</u>	<u>23</u>
<u>Q2</u>	<u>11</u>
<u>Q3</u>	<u>11</u>
<u>Q4</u>	<u>15</u>
Total	<u>60/100</u>

60% ✓ K.G.

Q1a

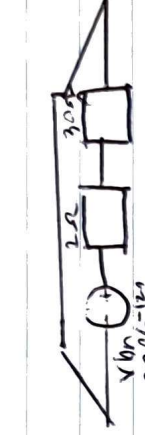
13/15

Q1)a) $V_{oc} = 220 \angle 0^\circ V$



$$= \frac{220 \angle 0^\circ}{2 + 20 - j10} = \frac{220 \angle 0^\circ}{22 - j10} = \frac{220 \angle 0^\circ}{24.47 \angle -24.44^\circ}$$

$$= 9.1 \angle 24.44^\circ A$$

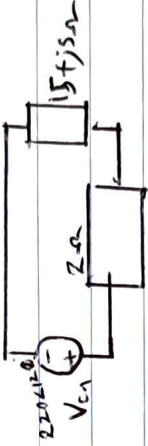


$$V_{th} = 220 \angle 120^\circ$$

$$I_b = \frac{220 \angle 120^\circ}{2 + j0} = \frac{220 \angle 120^\circ}{2} = 110 \angle 120^\circ A$$

$$V_{oc} = 220 \angle 120^\circ$$

$$I_c = \frac{220 \angle 120^\circ}{2 + 15 + j5} = \frac{220 \angle 120^\circ}{17 + j5} = \frac{220 \angle 120^\circ}{17.72 \angle 16.39^\circ} = 12.42 \angle 103.61^\circ A$$



$$I_{cn} = 12.42 \angle 103.61^\circ A$$

$$I_a = 9.1 \angle 24.44^\circ \quad R_{ec} = 8.284 + j3.77 \Omega$$

$$I_b = 6.88 \angle -120^\circ \quad R_{ec} = -3.44 - j5.96 \Omega$$

$$I_c = 12.42 \angle 103.61^\circ \quad R_{ec} = -2.92 + j12.07 \Omega$$

$$I_n = (8.28 + j3.77) + (-3.44 - j5.96) + (-2.92 + j12.07)$$

$$= 1.92 + j9.88 = 10.06 \angle 79^\circ$$

$I_n = ?$

Q1) b)

$$V_{an} = 220 \angle 0^\circ$$

$$(6-j2) + (12+j8) = 18+j6$$

$$I_a = \frac{220 \angle 0^\circ}{18+j6} = \frac{220 \angle 0^\circ}{18.97 \angle 18.43^\circ} = 11.6 \angle -18.43^\circ \text{ A}$$

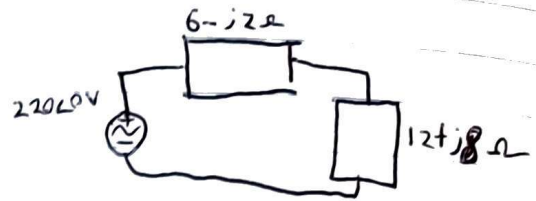
$$= 11.6 \angle -18.43^\circ \text{ A}$$

$$V_{bn} = 220 \angle -120^\circ$$

$$I_b = \frac{220 \angle -120^\circ}{18.97 \angle 18.43^\circ} = 11.6 \angle -138.43^\circ \text{ A}$$

$$V_{cn} = 220 \angle 120^\circ$$

$$I_c = \frac{220 \angle 120^\circ}{18.97 \angle 18.43^\circ} = 11.6 \angle 101.57^\circ \text{ A}$$



$$Q2) \frac{(60+j30)(-j10)}{60+j30-j10} = \frac{-j600 + 1800}{60+j20} = \frac{1800-j600}{63.25 \angle 18.43^\circ} = 1897.37 \angle -18.43^\circ$$

$$= 30 \angle -36.86^\circ = 24 - j18 \text{ units?}$$

$$\text{Total Impedance} = 20 + 24 - j18 = 44 - j18 = 47.54 \angle -22.25^\circ$$

Correct method

error carried forward

$$S = \frac{230 \angle 0^\circ}{47.54 \angle -22.25^\circ} = 8.84 \angle 22.25^\circ$$

3

Correct method

$$P = 47.54 \text{ W} \quad S = 8.84 \angle 22.25^\circ \text{ VA}$$

$$Q = 22.25 \text{ V} \quad P = 8.84 \text{ V}$$

$$Q = 22.25 \text{ V}$$

Q3/a) i) $V_{ab} = 330 \angle 0^\circ \text{ V}$ ✓
 $V_{bc} = 330 \angle -120^\circ \text{ V}$ ✓
 $V_{cb} = 330 \angle 120^\circ \text{ V}$ ✓

3

ii) $20 - j15 = 25 \angle -36.87^\circ$

$I_{ab} = \frac{330 \angle 0^\circ}{25 \angle -36.87^\circ} = 13.2 \angle 36.87^\circ \text{ A}$ ✓

$I_{bc} = \frac{330 \angle -120^\circ}{25 \angle -36.87^\circ} = 13.2 \angle -83.13^\circ \text{ A}$ ✓

$I_{ca} = \frac{330 \angle 120^\circ}{25 \angle -36.87^\circ} = 13.2 \angle 83.13^\circ \text{ A}$ ✓

iii)

$I_a = \frac{13.2 \angle 36.87^\circ}{0 \angle 30^\circ} = 13.2 \angle 6.87^\circ \text{ A}$ ✗

$I_b = \frac{13.2 \angle -83.13^\circ}{0 \angle 30^\circ} = 13.2 \angle -113.13^\circ \text{ A}$ ✗

$I_c = \frac{13.2 \angle 83.13^\circ}{0 \angle 30^\circ} = 13.2 \angle 53.13^\circ \text{ A}$ ✗

Q3) b) $4 + j3 = 5 \angle 36.87^\circ$

$I = \frac{208 \angle 0^\circ}{5 \angle 36.87^\circ} = 41.6 \angle -36.87^\circ = 33.28 - j24.96$

$P = 41.6$

Q3a
10/15

Q3b

1/10



Q4)

100 kVA

$$P \cdot t_1 = 0.6 \quad \checkmark$$

$$\cos \phi_1 = 0.6 \quad \checkmark$$

$$\phi_1 = 53.13 \quad \checkmark$$

$$S_1 = 100 \text{ kVA} \quad \checkmark$$

$$P = 56 \text{ kW} \quad \checkmark$$

$$Q_1 = 44.8 \text{ kVAR} \quad \checkmark$$

$$\rightarrow \dots 100,000 \sin(53.13) = 79,999.81$$

$$= 80 \text{ kVA} \quad \checkmark$$

$$\text{Power factor} = \frac{P}{S}$$

$$S = \frac{P}{\text{p.f.}} = \frac{56,000}{0.85} = 65,882.35$$

$$P_2 = 31.79 \quad \checkmark$$

$$P_2 = 56 \text{ kW} \quad \checkmark$$

$$S_2 = 66 \text{ kVA} \quad \checkmark$$

$$Q_2 = 35 \text{ kVAR} \quad \checkmark$$

$$66,000 \sin(31.79) = 34,769.29$$

$$= 35 \text{ kVAR} \quad \checkmark$$

error carried forward

$$Q_1 - Q_2 = 80 \text{ k} - 35 \text{ k} = 45 \text{ kV}$$

~~220V~~

3

~~frequency~~
 $\checkmark P = \text{Real power}$
 $\checkmark S = \text{apparent power}$
 $\checkmark Q = \text{Reactive power}$
 $\checkmark \text{p.f.} = \text{power factor}$

220V

50 Hz

$$S_2 = 2 \pi f Q_2 = 2 \pi \times 50 \times$$

$$\cos^{-1}(0.6) = 53.13$$



$$\text{Real power} = 100,000 \cos(53.13) = 56,000 \text{ W}$$

$$Q_2 = 60 \text{ kVAR}$$

Q4

15125