



Complete, fold and seal
(see note 2 below)

SURNAME: Smith

FORENAME(S): Josh

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	32 Smith16896861
2	Title of Examination Paper	Electrical power
3	Module Code	G0EE5000
4	Date and Time of Examination	15th of May 10:00
5	Examination Venue	Gower College Swansea
6	Seat Number	64
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Q1	
Q2	
Q3	
Q4	
Q1	16 ✓
Q2	1 ✓
Q3	18 ✓
Q4	1 ✓
Total	36/100 ✓

62

36%

Q1

$$a) \underline{S} = V = 240 \angle 0^\circ \text{ V}$$

$$S = V_{\text{rms}} \times I_{\text{rms}} = 240 \times 6.7 \angle 26.5^\circ$$

$$= 1608 \angle 26.5^\circ \text{ VA}$$

$$P = S \cos \theta = 1608 \cos 26.5^\circ = 1439 \text{ VAR}$$

$$\text{Pf} = \frac{P}{S} = \frac{1439 \angle 0^\circ}{1608 \angle 26.5^\circ} = 0.89 \angle -26.5^\circ$$

b)

$$Z_1 = 0 - j15 \quad Z_2 = j35 + 65$$

$$Z_{12} = \frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{(0 - j15)(j35 + 65)}{0 - j15 + j35 + 65} = \frac{-j525 + j975}{j20 + 65}$$

$$= \frac{110 \angle -3^\circ}{68 \angle 17.1^\circ} = 16.28 \angle -20.1^\circ$$

$$Z_T = Z_2 + Z_3 = 17.28 \angle -20.1^\circ + j15.98 + 25 = 36.53 \angle 11.48^\circ$$

$$P = S \cdot 240 \angle 0^\circ \times 38.29 \angle 17.44^\circ = 9184.6 \angle 17.44^\circ$$

$$P = 8768.16 \text{ W}$$

$$Q = j2754.18 \text{ VAR}$$

$$S = 220 \angle 0^\circ \times 32.37 \angle 29.54^\circ = 5141.4 \angle 29.54^\circ$$

$$= 4484.04 \text{ W} + j2541.08 \text{ VAR}$$

$$P = 4484.04 \text{ W}$$

$$Q = j2541.08 \text{ VAR}$$

Q1

16/30

Q1a

1/5

Q1b

15/25

Q2 a

a)

$$\cos \theta = \cos^{-1} 0.65 = 49.45^\circ$$

$$S_1 = 120 \times 0.65 = 78 \text{ units}$$

$$Q_1 = 78 \sin 49.45 = 59.267 \text{ units}$$

$$\cos \theta = \cos^{-1} 0.9 = 25.84^\circ$$

$$S_2 = 120 \times 0.9 = 108$$

$$Q_2 = 108 \sin 25.84^\circ = 47.07$$

$$X_{C1} = \frac{1}{2\pi \times 50 \times 59.27} = 53.7 \times 10^{-6}$$

$$X_{L1} = 2\pi \times 50 \times 53.7 \times 10^{-6} = 16.8 \times 10^{-3}$$

$$X_{C2} = \frac{1}{2\pi \times 50 \times 47.07} = 67.7 \times 10^{-6}$$

$$X_{L2} = 2\pi \times 50 \times 67.7 \times 10^{-6} = 21.2 \times 10^{-3}$$

value of capacitor = 67.7 μf

b)

?

Q2

1/25

Q2a

1/20

Q2b

0

Q3 a

$$i) V_{ab} = 240 \angle 0^\circ \text{ V}$$

$$V_{bc} = 240 \angle -120^\circ \text{ V}$$

$$V_{ca} = 240 \angle 120^\circ \text{ V}$$

$$ii) I_{aB} = \frac{240 \angle 0^\circ}{10 - j5 \Omega} = \frac{240 \angle 0^\circ}{11.18 \angle -26.56^\circ} = 19.68 \angle 26.56^\circ \text{ units}$$

$$I_{BC} = \frac{240 \angle -120^\circ}{11.18 \angle -26.56^\circ} = 19.68 \angle -93.44^\circ$$

$$I_{CA} = \frac{240 \angle 120^\circ}{11.18 \angle -26.56^\circ} = 19.68 \angle 146.56^\circ \text{ units}$$

$$I_a = 19.68 \sqrt{3} \angle -30^\circ + 26.56^\circ = 34.09 \angle -56.56^\circ \text{ A}$$

$$I_b = 34.09 \angle -176.56^\circ \text{ A}$$

$$I_c = 34.09 \angle 176.56^\circ \text{ A}$$

error carried forward

Q3

18/30

Q3a

13/15

b) i)

$$i) = \frac{400}{\sqrt{2}} = 282.84 \text{ units?}$$

$$ii) I = \frac{V}{R} = \frac{282.84}{6} = 47.14 \text{ A}$$

$$iii) S = 282.84 \times 47.14 = 13333.08 \text{ VA}$$

~~$$P = I^2 R = (47.14)^2 \times 6$$~~

$$P = VI \cos \phi = 282.84 \times 47.14 \cos 50^\circ$$

$$= 8570.33$$

$$PF = \frac{P}{S} = \frac{8570.33}{13333.08} = 0.66$$

$$iv) = V_p I_p \cos \phi = 282.84 \times 47.14 \cos 49.45^\circ$$

$$= 8667.99 \text{ units}$$

Q36

5/15

Q4

a)

Q41/15

?

0Q4a0

$$b) \frac{N_1}{N_2} = \frac{4}{1} \quad U_1 = 440 \quad I_2 = 20A$$

$$pf = 0.9$$

Q4b1/5

$$U_1 = U_2 \frac{N_1}{N_2} = 242$$

$$U_2 = U_1 \left(\frac{N_2}{N_1} \right) = 440 \left(\frac{1}{4} \right) = U_2 = 110 \text{ units}$$

$$I_1 = I_2 \left(\frac{N_1}{N_2} \right) = 20 \left(\frac{4}{1} \right) = 80 A$$

$$P = 440 \times 80 \cos \theta \cdot 0.84 = 30940.22 VA$$

$$\theta = \cos^{-1} 0.9$$