



Prifysgol Cymru
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University of Wales
Trinity Saint David

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	MOHL4817592
2	Title of Examination Paper	Electrical Power
3	Module Code	GOEE 5600
4	Date and Time of Examination	14/05/2026 1:32
5	Examination Venue	TYCQ1
6	Seat Number	

7	Number of Answer Books handed in	1
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Complete, fold and seal
(see note 2 below)

SURNAME: Mohsin

FORENAME(S): Amani

List the numbers of the questions you have attempted	Office Use
Q1	12 ✓
Q2	14 ✓
Q3	9 ✓
Q4	2 ✓
Total	37/100

37 %

(Gweler yr ochr arall am y fersiwn Cymraeg)

Q1 a)

$$Z_T = (j1.3\Omega) + (5 + j0.7\Omega) + (2 + j0.8\Omega)$$

$$Z_T = 7\Omega + j2.8\Omega$$

$$= 7.53 \angle 21.8^\circ$$

$$Pf = \cos \phi$$

show workings

$$= \cos(21.8^\circ)$$

4/5

$$= 0.9 \text{ lagging}$$

Q112/25Q1a4/5

b)

$$Z_1 = (0 - j10)$$

$$S = ?$$

$$Z_2 = (60 + j30)$$

$$P = ?$$

$$R = 20\Omega$$

$$V = 230 \angle 0^\circ$$

$$Q = ?$$

Q1b8/20

$$Z_T = \frac{Z_1 Z_2}{Z_1 + Z_2}$$

$$Z_T = 20 + \frac{(0 - j10)(60 + j30)}{(0 - j10) + (60 + j30)}$$

8/10

$$Z_T = 20 + \frac{-j10(60 + j30)}{60 + 20j} = 20 + \frac{-600j + 300}{60 + 20j}$$

$$Z_T = 20 + \frac{300 - 600j}{60 + 20j} = 26.45 - j4.64$$

$$Z_T = 20 + \frac{670.82 \angle -63.43^\circ}{63.24 \angle 18.43^\circ}$$

$$Z_T = 20 + \frac{670.82 \angle -63.43^\circ}{63.24 \angle 18.43^\circ}$$

$$Z_T = 20 + 10.60 \angle -81.86^\circ$$

$$Z_T = 30.6 \angle -81.86^\circ \Omega$$

$$S = \cos(-81.86^\circ)$$

$$S = 0.14$$

$$P = S \cos \phi$$

$$P = 30.6 \cos(-81.86^\circ)$$

$$P = 4.33 \text{ kW}$$

$$Q = S \sin \phi$$

$$= 30.6 \sin(-81.86^\circ)$$

$$Q = -29.69 \text{ VAR}$$

Q2 a)

1)

$$V_{ab} = V_p \angle 0^\circ = 330 \angle 0^\circ \text{ V}$$

$$V_{bc} = V_p \angle -120^\circ = 330 \angle (0^\circ - 120^\circ) \text{ V}$$

$$V_{ca} = V_p \angle +120^\circ = 330 \angle (0^\circ + 120^\circ) \text{ V}$$

$$Z_\Delta = 20 - j15 \Rightarrow \text{in Pol } 25 \angle -36.86^\circ$$

2)

$$I_{AB} = \frac{V_{ab}}{Z_\Delta} = \frac{330 \angle 0^\circ}{25 \angle -36.86^\circ} = 13.2 \angle 36.86^\circ$$

$$I_{BC} = \frac{V_{bc}}{Z_\Delta} = \frac{330 \angle -120^\circ}{25 \angle -36.86^\circ} = 13.2 \angle -83.14^\circ$$

$$I_{CA} = \frac{V_{ca}}{Z_\Delta} = \frac{330 \angle +120^\circ}{25 \angle -36.86^\circ} = 13.2 \angle 156.86^\circ$$

3)

$$I_a = I_{AB} \sqrt{3} \angle -30^\circ = 13.2 \sqrt{3} \angle (-30^\circ + 36.86^\circ)$$

$$= 22.86 \angle 6.86^\circ \text{ A}$$

$$I_b = I_a \angle -120^\circ = 22.86 \angle 6.86^\circ - 120^\circ = 22.86 \angle -113.14^\circ$$

$$I_c = I_a \angle +120^\circ = 22.86 \angle 6.86^\circ + 120^\circ = 22.86 \angle 126.86^\circ$$

$$4) P = S \cos \phi$$

$$P = 25 \cos(36.86^\circ)$$

$$P = 19.99 \text{ W}$$

Q214/25Q2a10/13

Q2(B)

$$\begin{aligned}
 1) \quad V_{an} &= V_p \angle 0^\circ = 220 \angle 0^\circ \text{ V} \\
 V_{bn} &= V_p \angle -120^\circ = 220 \angle -120^\circ \text{ V} \\
 V_{cn} &= V_p \angle +120^\circ = 220 \angle +120^\circ \text{ V}
 \end{aligned}$$

$$2) \quad V_{AB} = \sqrt{3} V_p \angle 30^\circ = \sqrt{3} \times 220 \angle 30^\circ = 381 \angle 30^\circ$$

$$\begin{aligned}
 V_{BC} &= V_{AB} \angle -120^\circ \\
 &= 381 \angle 30^\circ - 120^\circ = -90^\circ
 \end{aligned}$$

$$\begin{aligned}
 V_{CA} &= V_{AB} \angle +120^\circ \\
 &= 381 \angle 30^\circ + 120^\circ = 150^\circ
 \end{aligned}$$

$$\begin{aligned}
 3) \quad Z_Y &= 12 + j8 = 14.42 \angle 33.69^\circ \\
 I_{AN} &= I_a = \frac{V_{an}}{Z_Y} = \frac{220 \angle 0^\circ}{14.42 \angle 33.69^\circ} = 15.25 \angle -33.69^\circ
 \end{aligned}$$

$$I_{BN} = I_a \angle -120^\circ = 15.25 \angle -33.69^\circ - 120^\circ = -153.69^\circ$$

E.C.F.

$$I_{CN} = I_a \angle +120^\circ = 15.25 \angle -33.69^\circ + 120^\circ = 86.31^\circ$$

E.C.F.

Q2b4/12

4) $Z_{line} = 6 - j2 \Omega$ in pol = $6.32 \angle -18.43$

$$I_a = \frac{V_{an}}{Z_Y} = \frac{220 \angle 0^\circ}{6.32 \angle -18.43} = 34.81 \angle -18.43$$

$$I_b = I_a \angle -120 = 34.81 \angle -18.43^\circ - 120^\circ = -138.43^\circ$$

$$I_c = I_a \angle +120 = 34.81 \angle -18.43^\circ + 120^\circ = 101.57^\circ$$

5)

~~3X 6.32~~

1 0/3

Q3(a)

$$S = 120 \text{ KVA} \quad \checkmark$$

$$\text{lagging power factor} = 0.65 \quad \checkmark$$

$$V = 240 \text{ V} \quad \checkmark$$

$$f = 50 \text{ Hz} \quad \checkmark$$

$$P_f = 0.9 \quad \checkmark$$

$$P_{f1} = \cancel{\text{power}} 0.65 \quad \checkmark$$

$$P_{f1} = \cos \phi \quad \checkmark$$

$$P_{f2} = \cos^{-1}(0.9) \quad \checkmark$$

$$\phi = 25.84^\circ \quad \checkmark$$

$$\cos \phi = 0.65 \quad \checkmark$$

$$\phi = \cos^{-1}(0.65) = 49.45^\circ \quad \checkmark$$

$$Q_1 = 120 \sin(49.45^\circ) \quad \checkmark$$

$$\underline{\underline{415}}$$

$$Q_1 = 91.18 \text{ units?} \quad \checkmark$$

$$P = 120 \cos(49.45^\circ) \quad \checkmark$$

$$P = 78 \text{ W} \quad \underline{\underline{313}} \quad \checkmark$$

$$\cancel{P_{f2}} P_{f2} = \cos^{-1}(0.9) = 25.84^\circ \quad \underline{\underline{414}} \quad \checkmark$$

$$P = \frac{78}{0.9} = 86.6 \text{ W} \quad \times$$

$$Q = 120 \sin 25.84^\circ \quad \checkmark$$

$$Q = 52.30 \quad \times$$

$$Q_1 - Q_2 = \quad \times \text{ E.C.F.}$$

$$\cancel{P} = 91.18 - 52.30 = 38.88 \quad \times \text{ E.C.F.}$$

Q39/25Q3a9/20

$$X_C = \frac{1}{2\pi fC}$$

$$X_C = \frac{1}{2\pi (50 \times 10^{-6}) (38.8)} = 82 \mu F$$

Q3b0/5

Q4 a)Q42/25Q4a0/15

B)

$$V = 72 \text{ V}$$

$$R = 0.12 \Omega$$

$$\text{field } R = 0.05 \Omega$$

$$I = 30 \text{ A}$$

$$N = 1200 \text{ units?}$$

Q4b2/10

1)

$$E_a = K \phi \omega$$

$$\omega = \frac{2\pi N}{60}$$

$$\omega = \frac{2\pi (1200)}{60} = 125.66 \text{ units?}$$

$$E_a = V - R \times I$$

$$E_a = 72 - 0.12 \times 30$$

$$E_a = 68.4 \text{ units}$$

$$K\phi = \frac{E_a}{\omega} = \frac{68.4 \text{ E.C.F}}{125.66}$$

$$K\phi = 0.54 \quad \text{correct method}$$

$$E_a = K\phi \omega$$

$$= 0.54 \times 125.66$$

$$E_a = 67.85 \text{ rpm} \quad \times$$

$$2 = \omega$$

$$1200 \times 67.85$$

$$= 81420 \text{ per second} \quad \times$$

$$3) \quad P_m = T_d \omega$$

?

$$4) \quad T_d = K\phi i_a$$

?