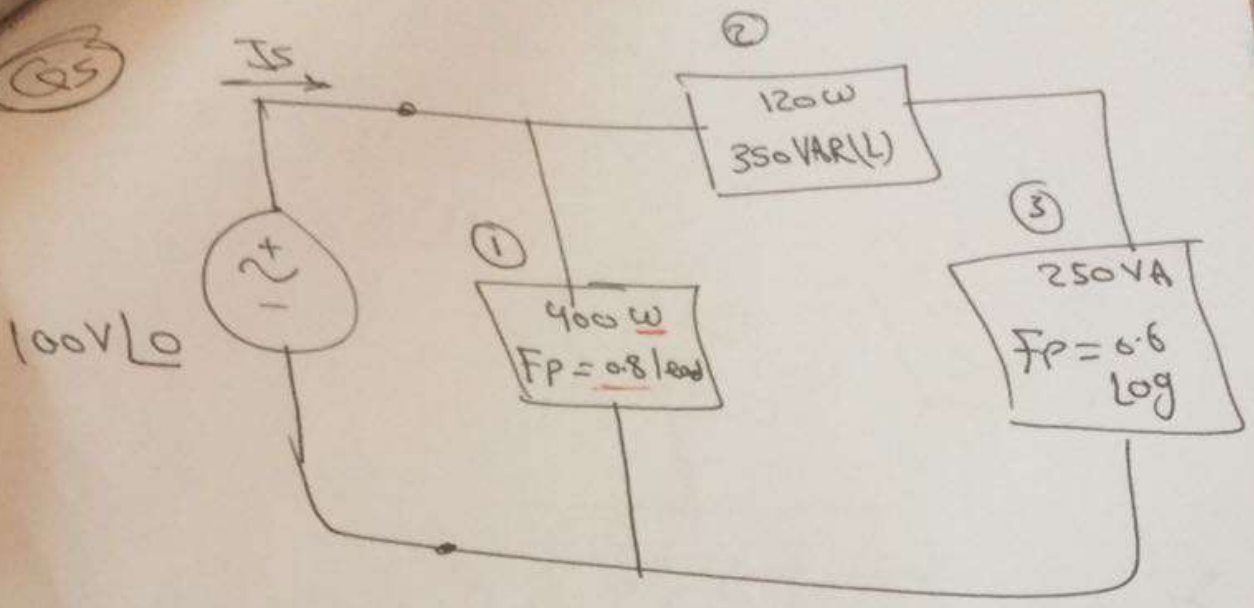
Q5



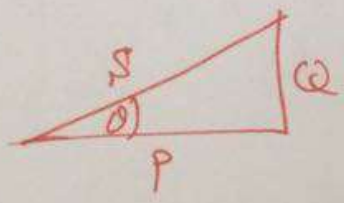
Find P_T & Q_T & S_T & FP & I_s & Z_{in} & X_C

Solution

① $P_1 = 400$ w.

FP = 0.8 lead

$\theta = \cos^{-1} 0.8 = 36.87$



$Q_1 = P_1 \tan\theta =$

$= 400 \tan 36.87 =$

$Q_1 = -300$ VAR

↓

lead.

line current

$$I_{line} = \sqrt{3}\, I_{ph} \angle -30$$

$$I_{Aa} = \sqrt{3} \times 8 \angle -30 - 36.87$$

$$I_{Aa} = 8\sqrt{3} \angle -66.87 \text{ A}$$

$$I_{Bb} = I_{Aa} \angle -120 = 8\sqrt{3} \angle -66.87 - 120$$

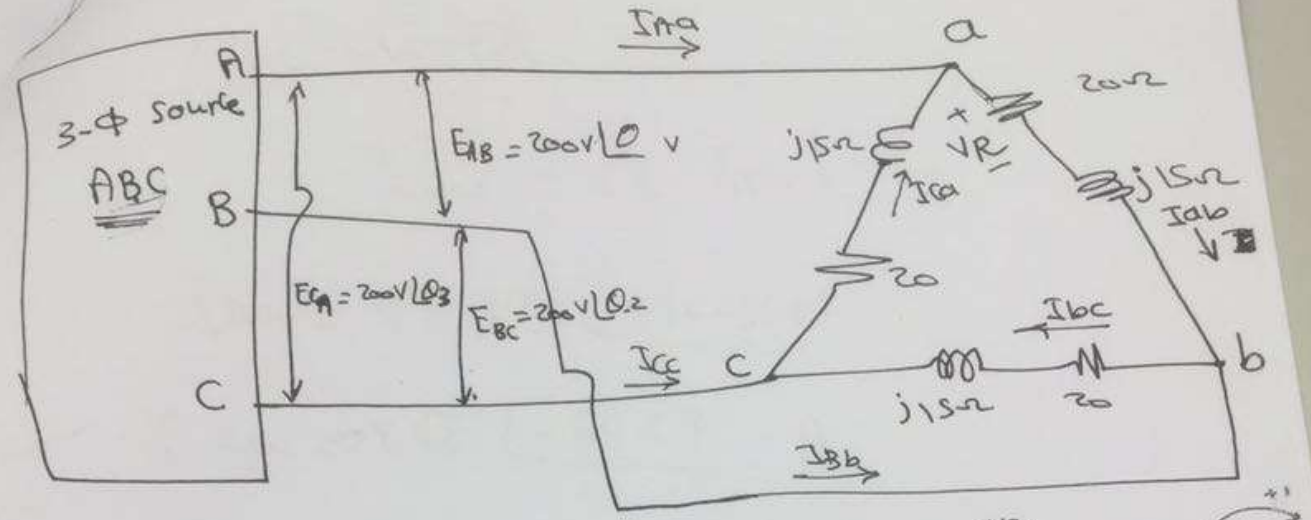
$$I_{Cc} = I_{Aa} \angle +120 = 8\sqrt{3} \angle -6687 + 120$$

V_R ??

$$V_R = I_{ab} \times R$$

$$V_R = 20 \times 8 \angle -36.87$$

$$V_R = 160 \angle -36.87$$



(a) find θ_2 & θ_3.

$\theta_2 = -120°$

$\theta_3 = +120°$

AB → 0
θ_2 → BC → −120
θ_3 → CA → +120

(b) Iab, Ibc, Ica:

$V_{ab} = E_{ab} = 200\angle 0$ V

$I_{ab} = \frac{V_{ab}}{Z_{ab}} = \frac{200\angle 0}{20 + j15} = 8\angle -36.87$

(ABC) +ve $I_{bc} = I_{ab}\angle -120 = 8\angle -36.87 - 120$

$I_{ca} = I_{ab}\angle +120 = 8\angle -36.87 + 120$

$I_{ca} = -I_{ac}$

$$FP = \frac{|P_T|}{|S_T|} = \frac{670}{715.12} = 0.936 \text{ Lag}$$

$$S = V_s I_s^*$$

$$I_s^* = \frac{S}{V_s} = \frac{715.12 \angle 20.46}{100 \angle 0}$$

$$I_s^* = 7.15 \angle 20.46$$

$$I_s = 7.15 \angle -20.46 \text{ A}$$

$$Z_{in} = \frac{V_s}{I_s} = \frac{100 \angle 0}{7.15 \angle -20.46}$$

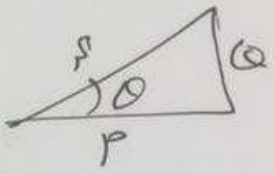
$$Z_{in} = 13.98 \angle 20.46 \ \Omega .$$

(2) $P_2 = 120\ w$

$Q_2 = +350\ VAR$

(3) $S_3 = 250\ VA$

$F_P = 0.6\ Log$



$\theta = \cos^{-1} 0.6 = 53.13$

$P_3 = S \cos\theta = 250 \times \cos 53.13 = 150\ w$

$Q_3 = S \sin\theta = 250 \times \sin 53.13 = +200\ VAR$

Log ↙

$P_T = P_1 + P_2 + P_3$

$= 400 + 120 + 150 = 670\ w$

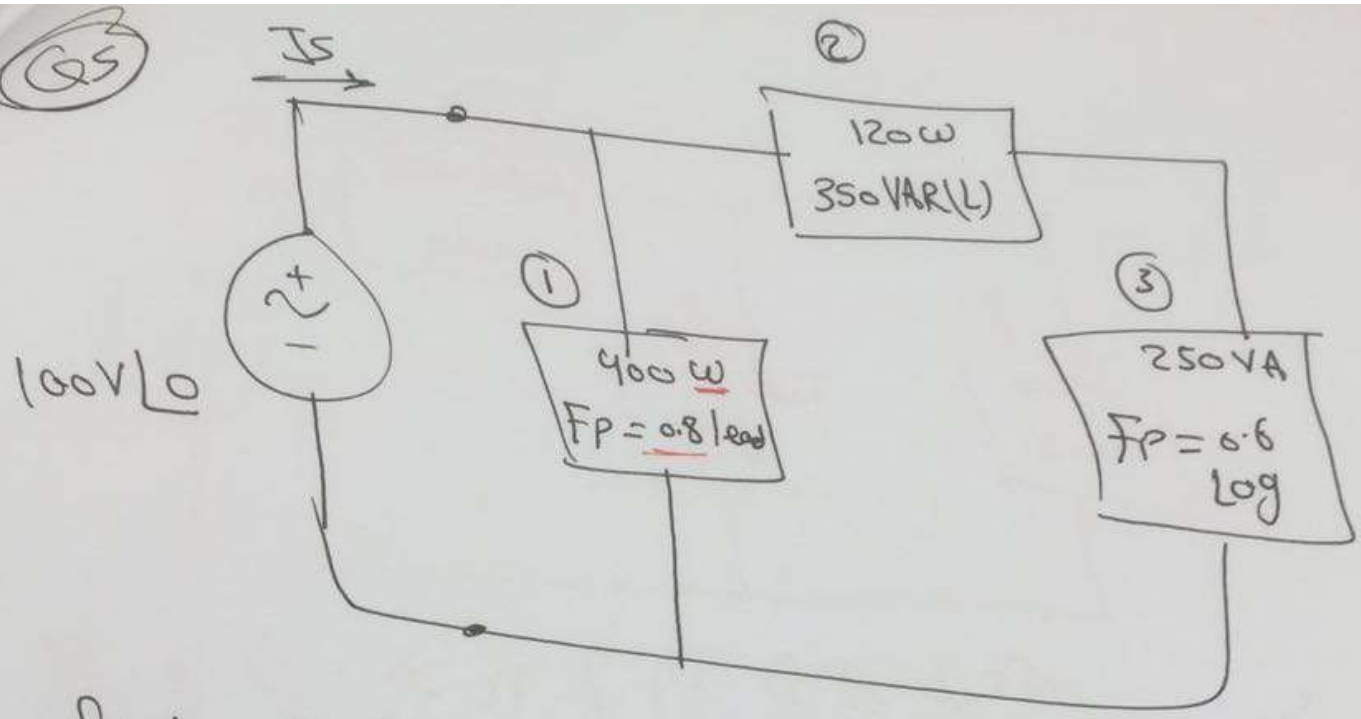
$Q_T = Q_1 + Q_2 + Q_3$

$= -300 + 350 + 200 = +250\ VAR$

$S_T = P_T + jQ_T = 670 + j250\ VA$

$S_T = 715.12 \angle 20.46\ VA$

Q5

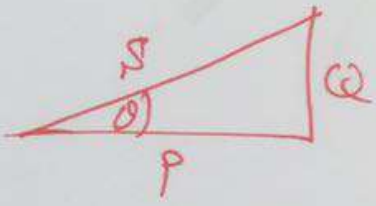


Find P_T & Q_T & S_T & FP & Is & Zin & X_C

Solution

(1) $P_1 = 400$ w.

FP = 0.8 lead



$\theta = \cos^{-1} 0.8 = 36.87$

$Q_1 = P_1 \tan\theta =$

$= 400 \tan 36.87 =$

$Q_1 = -300$ VAR

↓

lead.

$$\underline{S_{load}} = 3 V_{ph} I_{ph}^{*}$$

$$= 3 V_{ab} I_{ab}^{*}$$

$$S_{load} = 3 (200\angle 0)(8\angle +36.87)$$

$$S_{load} = 3840 + j2880 \quad VA$$

P ↓ ↓ Q

$$S_{load} = 4800 \angle 36.87 \ VA.$$

$$F.P. = \frac{|P_T|}{|S_T|} = \frac{3840}{4800}$$

$$F.P = 0.8 \ Lag$$

Lag ← Q_T موجب