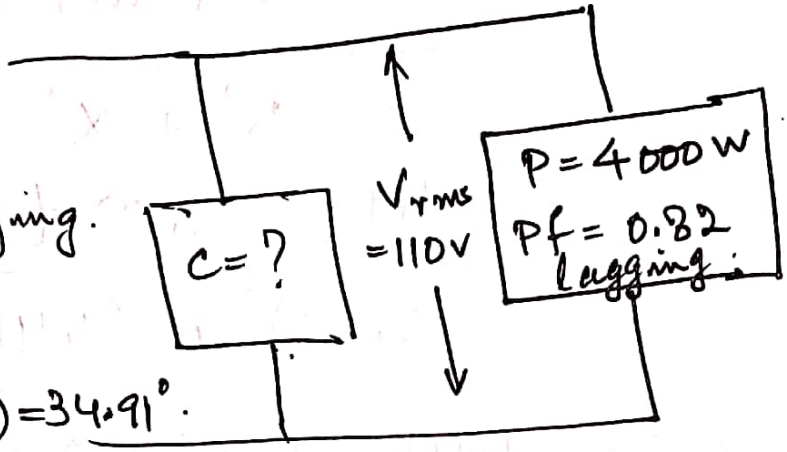
Exercise 11.6-4.

Solution



$P = 4000\ W.$

$Pf = 0.82$ lagging.

$\cos\theta = 0.82.$

$\theta = \cos^{-1}(0.82) = 34.91°.$

$V_{eff} = 110\ V.$

Since $P = V_{eff}\, I_{eff} \cos\theta$

$= \frac{V_m I_m}{2} \cos\theta.$

$$I_{eff} = \frac{P}{V_{eff}.\cos\theta} = \frac{4000}{110 \times 0.82.}$$

$$= 44.34\ Amp.$$

$$|Z| = \frac{V_{eff}}{I_{eff}} = \frac{110}{44.34} = 2.48.$$

$$\angle Z = \theta = 34.91°.$$

$$Z = |Z| \angle Z = 2.48 \angle 34.91°.$$

$$= 2.03 + j\,1.41\ \Omega.$$

Using formula.

$$\omega C = \frac{X - R \tan(\cos^{-1} pfc)}{R^2 + X^2}$$

$$= \frac{1.41 - 2.03 \tan(\cos^{-1}(0.95))}{(2.03)^2 + (1.41)^2}$$

$$\omega C = \frac{1.41 - 2.03 \times 0.32}{4.12 + 1.988} = 0.1244.$$

$$C = \frac{0.1244}{377} = 0.0003299\ F.$$

$$= 0.3299\ mF.$$