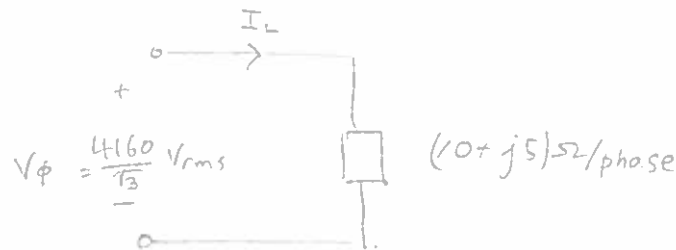


ECE 431 Exam

$$I^2 R = P$$

$$\frac{V^2}{R} = P$$

#1 $V_{\text{eff}} = 4160 \text{ Vrms}$
 $Z_{\Delta} = 30 + j15$



$$I_L = \frac{V_{\phi}}{Z_{\text{phase}}} = \frac{4160/\sqrt{3}}{10 + j5} = 192.142 - j96.07 = \boxed{214.8 \angle -26.56^\circ}$$

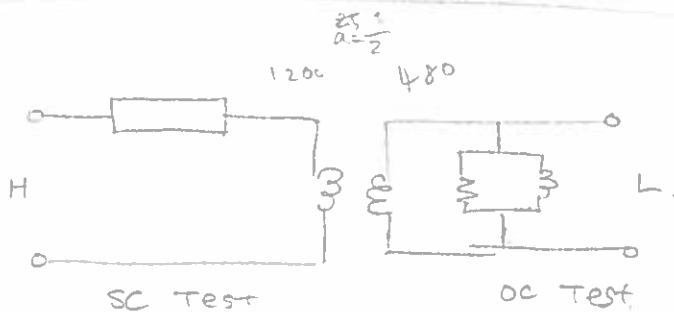
$$\theta = \angle V - \angle I = 26.56^\circ$$

(a) $P_1 = V_{\text{eff}} I_L \cos(30 + \theta) = (4160)(214.8) \cos(30 + 26.56) = \boxed{492.413 \text{ kW}}$

$P_2 = V_{\text{eff}} I_L \cos(30 - \theta) = (4160)(214.8) \cos(30 - 26.56) = \boxed{891.958 \text{ kW}}$

(b) $\frac{P_1 + P_2}{2} = P_1' = P_2' = \boxed{692.185 \text{ kW}}$ $I_1 = I_2 = \frac{P_1'}{V_{\text{eff}} \cos(30)} = \boxed{192.13 \text{ A}}$

#2



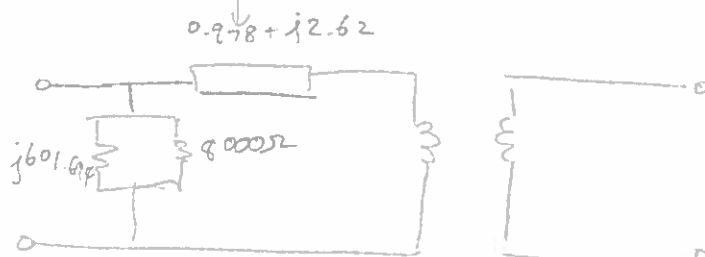
(a) $R_1 + R_2' = \frac{P}{I^2} = \frac{220}{15^2} = \boxed{0.978 \Omega}$

$$R_c = \frac{V^2}{P} = \frac{480^2}{180} = \boxed{1280 \Omega}$$

$$X_m = \frac{V}{\theta} = \frac{480^2}{\sqrt{(480)^2 - P}} = \boxed{96.271 \Omega}$$

$$X_1 + X_2' = \frac{\theta}{I^2} = \frac{\sqrt{(480)^2 - P}}{I^2} = \boxed{2.62 \Omega}$$

Should be moved to the source.



(b) $N_1 = 600$.

$$V = \frac{\partial \lambda}{\partial t} = NA \frac{\partial B}{\partial t}$$

$$V_{\text{peak}} = \omega NA B_{\text{peak}}$$

$$1200\sqrt{2} = (2\pi f)(600)A(1T)$$

$$A = 0.0075 \text{ m}^2$$

$$= \boxed{75 \text{ cm}^2}$$

#3

$$\alpha = \beta = \frac{\pi}{6} = 30^\circ$$

$$R = 50 \text{ mm}$$

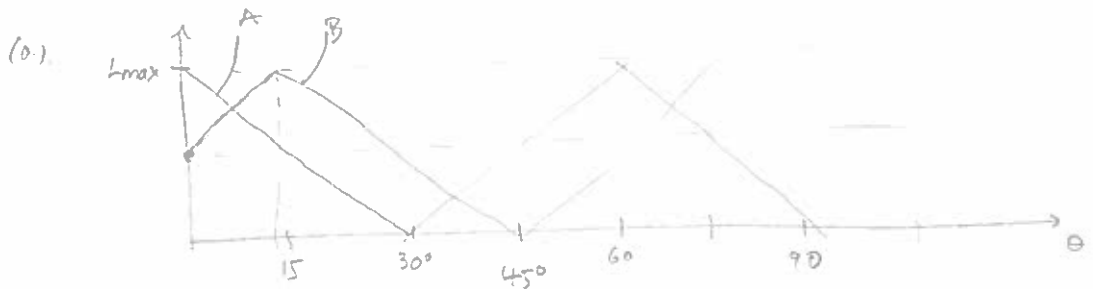
$$g = 0.1 \text{ mm}$$

$$N = 10$$

$$D = 20 \text{ mm}$$

$$L_{\text{max}} = \frac{N^2 \mu_0 R D \alpha}{2g}$$

$$= \boxed{0.329 \text{ mH}}$$



(c) $A - D - C - B$.

(d) $S = mNr = 4 \cdot 6 = 24 \text{ steps/rev.}$

(e) Double $g \rightarrow \frac{1}{2} L_{\text{max}}$.

Torque is halved.