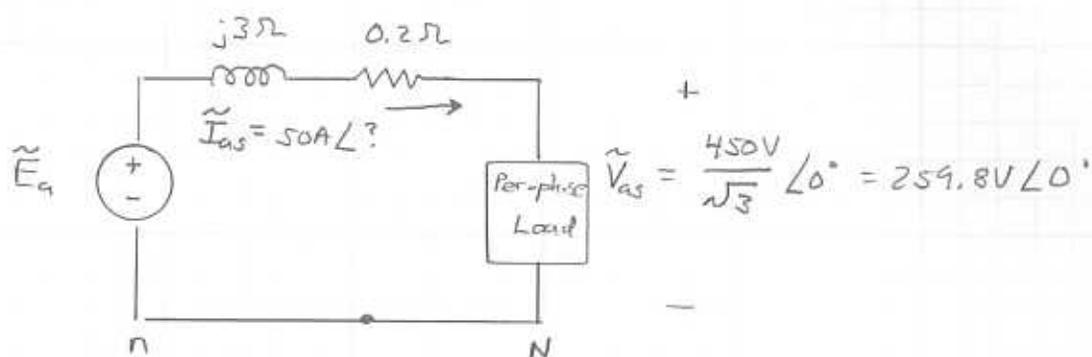


35.1

Since  $\angle Z = +30^\circ$  and  $\angle Z = \angle \tilde{V}_{as} - \angle \tilde{I}_{as}$  with  $\tilde{V}_{as}$  as the reference phasor  $\rightarrow \angle \tilde{I}_{as} = -30^\circ$

a, b.  $-\tilde{E}_a + (j3 + 0.2)\tilde{I}_{as} + \tilde{V}_{as} = 0$

so  $\tilde{E}_a = 259.8V \angle 0^\circ + (j3 + 0.2)(50A \angle -30^\circ)$

$$\tilde{E}_a = 365.5V \angle 20^\circ$$

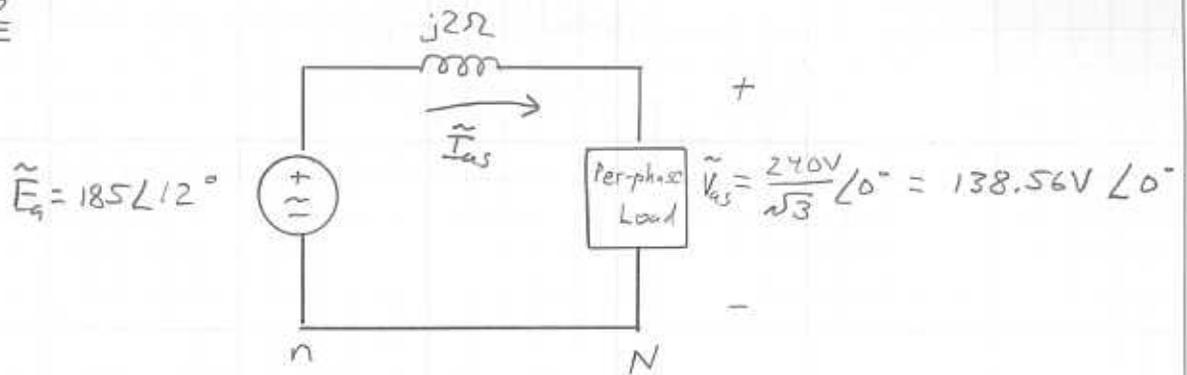
$$|\tilde{E}_a| = 365.5V \quad \delta = +20^\circ$$

c.  $N_m = \frac{120 F_e}{P} \rightarrow P = \frac{120 F_e}{N_m} = \frac{120(60)}{900} = 8$

d.  $P_{3\phi} = 3|\tilde{V}_{as}||\tilde{I}_{as}|\cos(\angle \tilde{V}_{as} - \angle \tilde{I}_{as})$

$$P_{3\phi} = 3(259.8)(50A)\cos(30^\circ) = 33.75kW$$

35.2



a. See  $\tilde{V}_{as}$  in figure

b. 
$$-\tilde{E}_g + j2\Omega \tilde{I}_{as} + \tilde{V}_{as} = 0$$

$$\tilde{I}_{as} = \frac{\tilde{E}_g - \tilde{V}_{as}}{j2\Omega} = \frac{185 \angle 12^\circ - 138.56 \angle 0^\circ}{j2\Omega}$$

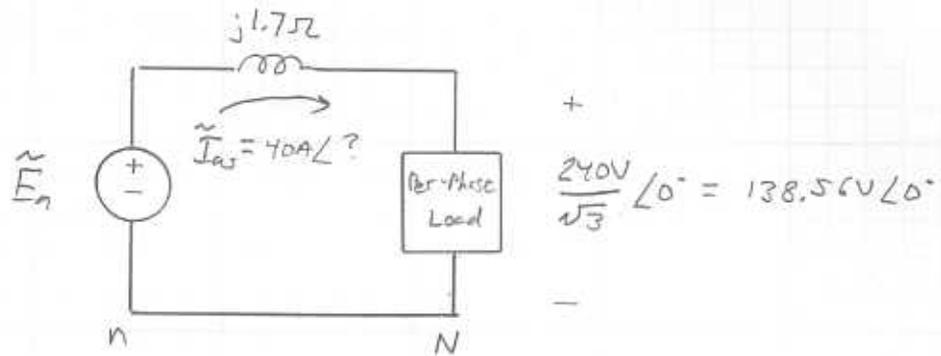
$$\rightarrow \tilde{I}_{as} = 28.62 \text{ A} \angle -47.79^\circ$$

c. 
$$\text{pf} = \cos(\angle \tilde{V}_{as} - \angle \tilde{I}_{as}) = \cos(0^\circ + 47.79^\circ) = 0.67 \text{ lagging}$$

d. 
$$N_m = \frac{120 f_e}{P} = \frac{120 (50)}{4} = 1500 \text{ rpm}$$

e. 
$$T_{dev} = \frac{P}{\omega_e} \frac{3 V_s E_g}{X_s} \sin \delta$$
$$= \frac{4}{2} \frac{3 (138.56) (185)}{(2\pi 50)(2)} \sin(12^\circ)$$
$$= 50.89 \text{ N-m}$$

35.3



9.  $\phi_{PF} = \cos^{-1}(\text{pf}) = \cos^{-1}(0.9) = 25.8^\circ = \angle \tilde{V}_{as} - \angle \tilde{I}_{as}$

$$\rightarrow \angle \tilde{I}_{as} = -25.8^\circ$$

$$-\tilde{E}_g + j1.7 \tilde{I}_{as} + \tilde{V}_{as} = 0$$

$$\tilde{E}_g = j1.7 (40A \angle -25.8^\circ) + 138.56V \angle 0^\circ$$

$$\tilde{E}_g = 179V \angle 20^\circ$$

For the new condition  $\tilde{I}_{as2} = 50A \angle -25.8^\circ$

so

$$\tilde{E}_{g2} = j1.7 \tilde{I}_{as2} + \tilde{V}_{as} = j1.7 (50A \angle -25.8^\circ) + 138.56V \angle 0^\circ$$

$$= 191.5V \angle 23.5^\circ$$

since  $|\tilde{E}_g| = \frac{L_{SF} I_F \omega_e}{\sqrt{2}}$  then

$$\frac{|\tilde{E}_g|_1}{|\tilde{E}_g|_2} = \frac{I_{F1}}{I_{F2}} = \frac{179V}{191.5V}$$

Thus  $\frac{I_{F2}}{I_{F1}} = 1.07$       b.  $\delta_1 = 20^\circ$   
 $\delta_2 = 23.5^\circ$