

P10.1

$$a) P = \frac{1}{2} (340)(20) \cos(60^\circ - 15^\circ) = 3400 \cos 45^\circ = 2404.16 \text{ W (abs)}$$

$$Q = 2400 \sin 45^\circ = 2404.16 \text{ VAR (abs.)}$$

$$b) P = \frac{1}{2} (16)(75) \cos(-15^\circ - 60^\circ) = 600 \cos(-75^\circ) = 155.29 \text{ W (abs.)}$$

$$Q = 600 \sin(-75^\circ) = -579.56 \text{ VAR (del.)}$$

$$c) P = \frac{1}{2} (625)(4) \cos(40^\circ - 150^\circ) = 1250 \cos(-110^\circ) = -427.53 \text{ W (del.)}$$

$$Q = 1250 \sin(-110^\circ) = -1174.62 \text{ VAR (del.)}$$

$$d) P = \frac{1}{2} (180)(10) \cos(130^\circ - 20^\circ) = 900 \cos 110^\circ = -307.82 \text{ W (del.)}$$

$$Q = 900 \sin(110^\circ) = 845.72 \text{ VAR (abs.)}$$

P10.5

$$i(t) = \frac{30}{40} \times 10^3 t = 750t \quad 0 \leq t \leq 40 \text{ ms}$$

$$i(t) = M - \frac{30}{10} \times 10^3 t \quad 40 \text{ ms} \leq t \leq 50 \text{ ms}$$

$$i(t) = 0 \quad \text{when } t = 50 \text{ ms}$$

$$\therefore M = 3000 (50 \times 10^{-3}) = 150$$

$$i(t) = 150 - 3000t \quad 40 \text{ ms} \leq t \leq 50 \text{ ms}$$

$$\therefore I_{\text{rms}} = \sqrt{\frac{1000}{50} \left[\int_0^{0.04} (750t)^2 dt + \int_{0.04}^{0.05} (150 - 3000t)^2 dt \right]}$$

$$= \sqrt{300} = 17.32 \text{ A}$$

P10.10

2/3

$$a) \bar{Z}_1 = 240 + j70 = 250 \angle 16.26^\circ \Omega$$

$$P.f. = \cos(16.26^\circ) = 0.96 \text{ lagging.}$$

$$r.f. = \sin 16.26^\circ = 0.28$$

$$\bar{Z}_2 = 160 - j120 = 200 \angle -36.87^\circ \Omega$$

$$P.f. = \cos(-36.87^\circ) = 0.80 \text{ leading}$$

$$r.f. = \sin(-36.87^\circ) = -0.60$$

$$\bar{Z}_3 = 30 - j40 = 50 \angle -53.13^\circ \Omega$$

$$P.f. = \cos(-53.13^\circ) = 0.6 \text{ leading}$$

$$r.f. = \sin(-53.13^\circ) = -0.8$$

$$b) \bar{Y} = \bar{Y}_1 + \bar{Y}_2 + \bar{Y}_3$$

$$\bar{Y}_1 = \frac{1}{250 \angle 16.26^\circ}, \bar{Y}_2 = \frac{1}{200 \angle -36.87^\circ}, \bar{Y}_3 = \frac{1}{50 \angle -53.13^\circ}$$

$$\bar{Y} = 19.84 + j17.88 \text{ mS}$$

$$\bar{Z} = \frac{1}{\bar{Y}} = 37.44 \angle -42.03^\circ \Omega$$

$$P.f. = \cos(-42.03^\circ) = 0.74 \text{ leading}$$

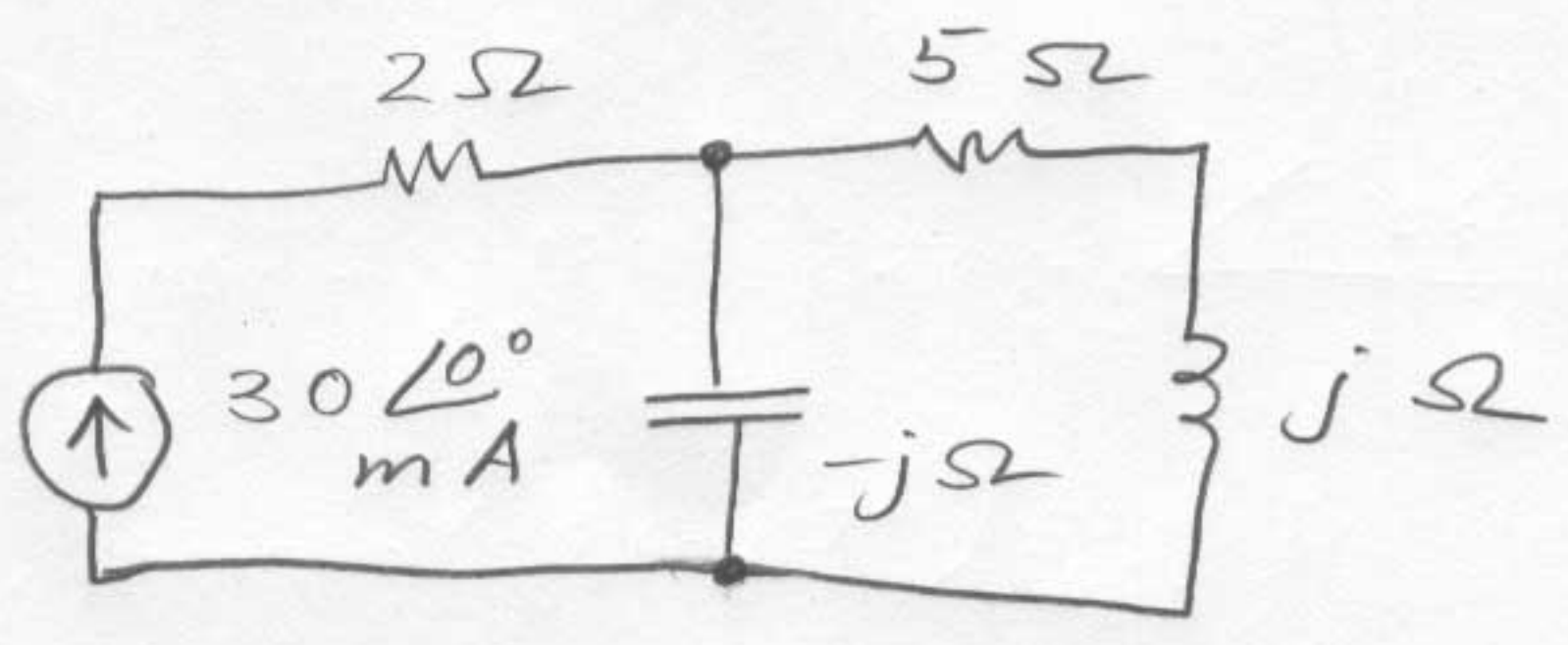
$$r.f. = \sin(-42.03^\circ) = -0.67$$

P 10.12

3/3

$$\bar{I}_g = 30 \angle 0^\circ \text{ mA}, \quad \frac{1}{j\omega C} = \frac{10^6}{j(25 \times 10^3)(40)} = -j1 \Omega$$

$$j\omega L = j(25 \times 10^3) \times 40 \times 10^{-6} = j1 \Omega$$



$$\bar{Z}_1 = -j // (5 + j) = 0.2 - j \Omega$$

$$\bar{Z}_{eq} = 2 + \bar{Z}_1 = 2.2 - j \Omega$$

$$P_g = |I_{rms}|^2 \text{Re}(\bar{Z}_{eq}) = \left(\frac{30}{\sqrt{2}} \times 10^{-3} \right)^2 (2.2)$$

$$= 990 \mu \text{ W}$$