

#1  $-200 = 230 \times 15 (\cos(\angle \bar{V}_{AB} - \angle \bar{I}_A)) = 3450 \cos(30 - (-\phi))$   
 $\phi = 63.3^\circ$   $P_{3\phi} = \sqrt{3} \times 230 \times 15 \cos 63.3^\circ = 2683 \text{ W}$   
 $Q_{3\phi} = \sqrt{3} \times 230 \times 15 \sin 63.3^\circ = 5338 \text{ vars}$

#2 (a) 100% V gives  $\frac{100}{7} I_{\text{rated}}$ , so 7% V gives  $I_{\text{rated}}$   
 $V = 7200 \times 0.07 = 504 \text{ V}$   
 (b)  $\text{kVA}_{3\phi} (\text{closed } \Delta\Delta) = 75 \text{ kVA}$  open delta reduce to 57%  
 $\text{kVA}_{3\phi} (\text{open delta}) = 75 \times 0.57 \text{ kVA}$   
 $= 43 \text{ kVA}$

#3 To estimate, neglect  $r_1$ ,  $x_1$ ,  $x_2'$

(a)  $T_{\text{To shaft}} \approx \frac{3 \times \left(\frac{230}{\sqrt{3}}\right)^2 s}{2\pi 60/2} = .16 (1-s) 2\pi 60/2$   $s \approx .097$   
 $\omega \approx 170 \text{ rad/s}$   $\text{RPM} \approx 1625$   
 (b)  $T_{\text{To shaft}} \approx \frac{3 \times \left(\frac{153}{\sqrt{3}}\right)^2 s}{2\pi 40/2} = .16 (1-s) 2\pi 40/2$   $s \approx .097$   
 $\omega \approx 113 \text{ rad/s}$   $\text{RPM} \approx 1083$

(c)  $\bar{I}_{(a)} \approx \frac{230/\sqrt{3}}{j20} + \frac{230/\sqrt{3}}{1/.097} = -j6.6 + 12.9$   $|\bar{I}| \approx 14.5 \text{ A}$

$\bar{I}_{(b)} = \frac{153/\sqrt{3}}{j20(4/6)} + \frac{153/\sqrt{3}}{1/.097} = -j6.6 + 8.6$   $|\bar{I}| \approx 10.8 \text{ A}$

#4 (a)  $Q_{1\phi} \approx \frac{(230/\sqrt{3})^2}{20} + 14.5^2 \times \frac{4}{6} + 12.9^2 = 1258 = 230^2 \times 2\pi 60 C$   $C = 63 \mu\text{F}$

(b)  $Q_{1\phi} \approx \frac{(153/\sqrt{3})^2}{20(4/6)} + 10.8^2 \times \frac{4}{6} + 8.6^2 = 712 = 153^2 \times 2\pi 40 C$   $C = 121 \mu\text{F}$