ECE 333

Second Exam Solution — Spring 95

#1 O.C. test $kw \times 2 = \frac{480}{\sqrt{2}} = 277$ $\quad kw = 138.5\ \Omega$

S.C. test $138.5 \times .8 = 10 X_s$ $\quad X_s = 11.1\ \Omega$

$$138.5 I_f \angle 8 = 11.1\angle 90^\circ \times \frac{3000/.85}{277}\angle -32^\circ + 277\angle 0$$

$$= 141.4\angle 58^\circ + 277\angle 0 = 352 + j120$$

$$138.5 I_f = 371.9 \qquad \underline{I_f = 2.7\ A}$$

#2 Zero line current $kw \times 1.8 = \frac{230}{\sqrt{3}}$ $\quad kw = 73.8\ \Omega$

Zero internal voltage $7X_s = 230/\sqrt{3}$ $\quad X_s = 18.97\ \Omega$

(a) $P_{max} = \frac{3 \times \frac{230}{\sqrt{3}} \times 73.8 \times 3}{18.97} = \underline{4650\ w}$ (3 phase)

(b) Underexcited because $Q_{IN} > 0$

#3 $\left(\frac{250 I_{SH}}{3 + I_{SH}}\right)\frac{1300}{1200} = 1 \times (8 + I_{SH}) + 25 I_{SH} = 8 + 26 I_{SH}$

(a) $271 I_{SH} = (3 + I_{SH})(8 + 26 I_{SH})$

$$271 I_{SH} = 24 + 78 I_{SH} + 8 I_{SH} + 26 I_{SH}^2$$

$$I_{SH}^2 - 7.12 I_{SH} + 0.92 = 0 \qquad I_{SH} = 3.56 \pm 3.43$$

$$I_{SH} = 7.0\ A \qquad \underline{V_t = 175\ V}$$

(b) It would be lower because of demagnetization

#4 $E_{a_{NL}} = K \times 1257 \times \frac{2\pi}{60}\frac{240}{80} = 240$ $\quad K = 0.61$

$$20 = \frac{0.61 \times w \times \frac{240}{80} \times I_a}{w} \qquad I_a = 10.93\ A \qquad E_a = 240 - 10.93$$

$$= 229.07\ v$$

$$.61 \times w \times \frac{240}{80} = 229.07 \qquad w = 125.2\ rps = \underline{1196\ rpm}$$