

76)  $P_{cu} \cdot P_{fe} = 4\%$   
 $P_{cu} = P_{sc} = 9\%$

$\rightarrow \eta_{max} \rightarrow P_{cu} = P_{fe} \rightarrow k = \sqrt{\frac{P_{fe}}{P_{cu}}} = \frac{2}{3}$

$\rightarrow \eta = \frac{\frac{2}{3} \times 1}{\frac{2}{3} \times 1 + \frac{9}{100} \times \frac{2}{3} + \frac{4}{100}} = \frac{k C_{osp}}{k C_{op} + k^2 P_{cu} + P_{fe}} = \frac{\frac{2}{3}}{\frac{2}{3} + \frac{8}{100}} = \frac{\frac{2}{3}}{\frac{200 + 24}{300}} = \frac{100}{112}$   
 2.8 %

77)  $f_2 = \frac{1}{2} \frac{dR}{dx} \varphi^2 - \frac{1}{2} \frac{dR}{dx} \varphi^2$   
 $\varphi = \frac{\sum Ni}{R}$   
 $f = \frac{1}{2} \frac{dR}{dx} \times \frac{N^2}{R^2} \times l$   
 در صورتات بعدی است

$(Ni)_{eff} = 100 \times 1 + 50 \times 4 = -100$   
 در حالت اول  
 $(Ni)_{eff} = 100 \times 1 + 50 \times 4 = 300$   
 در حالت دوم

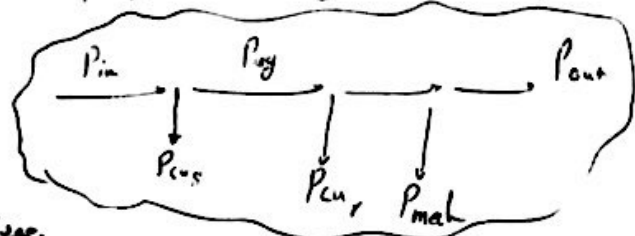
$\rightarrow \frac{f_2}{f_1} = \frac{(Ni)_2^2}{(Ni)_1^2} = \frac{300^2}{-100^2} = 9 \rightarrow f_2 = 9 f_1$   
 2.8 %

78) ماتریس  $L = \begin{bmatrix} 0.8 & 0.4 & -0.5 \\ 0.4 & 0.3 & 0 \\ -0.5 & 0 & 0.5 \end{bmatrix} \rightarrow \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \end{bmatrix} = \begin{bmatrix} L_{11} & L_{12} & L_{13} \\ L_{21} & L_{22} & L_{23} \\ L_{31} & L_{32} & L_{33} \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix}$

$\rightarrow d w_f = i_1 d \lambda_1 + i_2 d \lambda_2 = i_1 d(L_{11} i_1 + L_{12} i_2 + L_{13} i_3) + i_2 d(L_{21} i_1 + L_{22} i_2 + L_{23} i_3)$

$w_f = \frac{1}{2} L_{11} i_1^2 + \frac{1}{2} L_{22} i_2^2 + \frac{1}{2} L_{33} i_3^2 + L_{12} i_1 i_2 + L_{13} i_1 i_3 + L_{23} i_2 i_3$   
 $= 0 + 0 + 0 + (0.4) + (0.15) + (0.25) + (0.4) - (0.5) + 0 = 0.7$   
 1.7 %

79)  $s = 5\%$  &  $\begin{cases} P_{cu_s} = P_{cu_r} = 5\% P_{ag} & P_{mah} = 5\% P_{ag} \\ P_{cu_s} = P_{cu_r} = 5\% P_{ag} \end{cases}$



$\eta = \frac{P_{out}}{P_{in}} = \frac{P_{ag} - P_{cu_r} - P_{mah}}{P_{ag} + P_{cu_s}} = \frac{100 - 0.05 - 0.05}{100 + 0.05} = \frac{90}{105}$   
 2.8 %

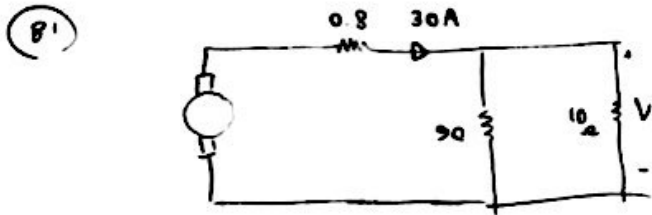


80  $V_t = 200\text{ V}$   
 $n = 1500\text{ rpm}$   
 $I_a, I_s = 40\text{ A}$   
 $R_a, R_s = \frac{1}{2}$

$E_a = 200 - 40 \times \frac{1}{2} = 180\text{ V} \quad \& \quad 40\text{ A}$

کوتاه مدار، بار 40A و ولتاژ 90 ولت است

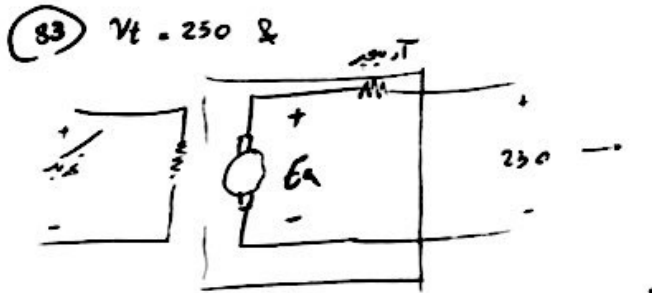
$\frac{180}{90} = \frac{E_2}{E_1} = \frac{N_2}{N_1} \rightarrow 2 = \frac{1500}{n_1} \rightarrow n_1 = 750\text{ rpm}$  3 نوبت



$R_f \parallel R_c = 90 \parallel 10 = 9\ \Omega$   
 $V_t = 270\text{ V}$   
 $E_a + 270 + 0.8 \times 30 = 294\text{ V}$  4 نوبت

82  $\frac{T_{st}}{T_{fl}} = \left(\frac{I_{st}}{I_{fl}}\right)^2 \times \eta_{fl} \rightarrow 3 = 5^2 \times \eta_{fl} \rightarrow \eta_{fl} = 12\%$

$\left(\frac{T_{st}}{T_{fl}}\right) = \left(\frac{3}{1}\right)^2 \times \eta_{fl} = 3^2 \times 12\% = 9 \times \frac{3}{25} = \frac{27}{25} \rightarrow T_{st} = \frac{27}{25} \times T_{fl}$  4 نوبت



$P_{ar} = 10\text{ kW} = 250 \times I_a \rightarrow I_a = 40\text{ A}$   
 $\& \quad T_1 = T_2 \rightarrow \frac{T_2}{T_1} = \frac{P_2}{P_1} \times \frac{I_{a2}}{I_{a1}} = 1$

$I_a = \text{تایم ثابت}$

$\frac{E_{a2}}{E_{a1}} = \frac{P_2}{P_1} \times \frac{N_2}{N_1} \rightarrow \frac{150 - \frac{1}{4} \times 40}{250 - \frac{1}{4} \times 40} = \frac{N_2}{1600}$

$\frac{140}{240} \times 1600 = N_2 = 933.33\text{ rpm}$  3 نوبت



84) سرعت میدان رتور = سرعت میدان استاتور

$$\& \frac{\text{سرعت میدان رتور نسبت به بدنه استاتور}}{N_s} = \frac{1000}{1000 - 900} = 10 \quad \text{لزیمه 2}$$

$$\rightarrow \omega = N_s - N_m$$

$$\rightarrow N_s = \frac{120 \times f}{p} = 1000 \text{ rpm} \quad \& \quad N_m = 900$$

باتوجه به سرعت بارکندگی که 900 است باید تغییر دهیم تعداد قطبها 6 بوده اند

85

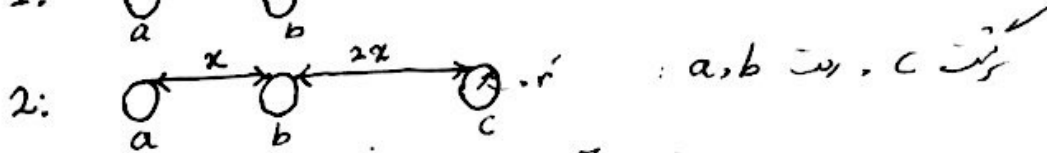
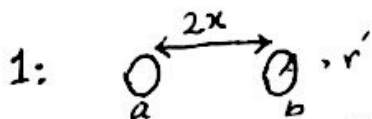
$$\left\{ \begin{aligned} \Delta V_{\text{max}} = Z_{eq} = 10\% \\ P_{sc} - R_{eq} = \frac{250}{5000} = 5\% \end{aligned} \right. \xrightarrow{LV=0} \cos \phi = \frac{X_{eq}}{Z_{eq}} = \frac{\sqrt{3}}{2}$$

در این حالت ولتاژ دارد

$$\frac{R_{eq}}{Z_{eq}} = \frac{1}{2} \rightarrow \frac{X_{eq}}{Z_{eq}} = \frac{\sqrt{3}}{2}$$

بار بیش فاز ما به باقی





$$L_1 = L_2 \rightarrow \begin{cases} L_1 = 2 \left( 2 \times 10^{-7} \ln \frac{2x}{r'} \right) \\ L_2 = 2 \times 10^{-7} \left( \ln \frac{\sqrt{(2x)(3x)}}{\sqrt{2}r'} + \ln \frac{\sqrt{(2x)(3x)}}{r'} \right) \end{cases}$$

$$\rightarrow \left( \frac{2x}{r'} \right)^2 = \frac{6x^2}{r' \sqrt{2x} r'} \rightarrow \frac{x}{r'} = \frac{9}{4}$$

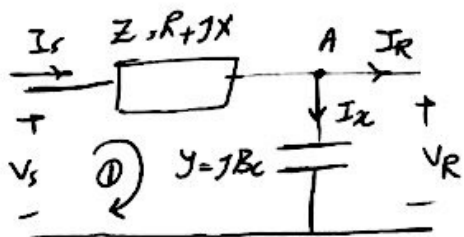
$$V_i^{(k+1)} = \frac{P_i^{sch} - jQ_i^{sch}}{V_i^{*(k)}} + \frac{\sum Y_{ij} V_j^{(k)}}{\sum Y_{ij}}$$

87 - در این ها  $P^{sch}$  و  $Q^{sch}$  مقصودند

$$V_2 = \frac{-0.5 + j0.2 + \left[ \frac{1}{0.2j} + \frac{1}{0.2j} \right]}{1} = \frac{-0.5 + j0.2 - 10j}{-10j}$$

$$= 1 - 0.02 - 0.05j = 0.98 - 0.05j$$

گزینه (3)



88 -

KVA:  $I_s = I_R + I_x \rightarrow I_s = I_R + Y V_R \rightarrow$  گزینه (3)

KVL ①:  $\left. \frac{V_s}{V_R} \right|_{I_R=0} = \frac{Z + \frac{1}{Y}}{\frac{1}{Y}} = 1 + YZ$ ,  $\left. \frac{V_s}{I_R} \right|_{V_s=0} = Z$

$I_R=0 \rightarrow$  تقسیم امپدانس ساده

$V_s=0 \rightarrow$  دوسر لا اتصال کوتاه



$$1. \begin{cases} f, 50 \text{ Hz} \\ l, 1 \text{ km} \end{cases}$$

$$2. \begin{cases} f, 60 \text{ Hz} \\ l, 100 \text{ km} \end{cases}$$

39 - گزینہ (2)

$$X_L = L\omega l, \quad X_C = \frac{1}{C\omega l}$$

$$A_2 \frac{X_L}{X_C} = LC\omega^2 l^2 \longrightarrow \frac{A_2}{A_1} = \left(\frac{\omega_2}{\omega_1}\right)^2 \left(\frac{l_2}{l_1}\right)^2 = 1.44 \times 10^4$$

$$\begin{bmatrix} V_s \\ I_s \end{bmatrix} = \begin{bmatrix} \cos \beta l & jZ_c \sin \beta l \\ \frac{-j}{Z_c} \sin \beta l & \cos \beta l \end{bmatrix} \begin{bmatrix} V_R \\ I_R \end{bmatrix}$$

90

$$V_s = V_m \cos \frac{\beta l}{2} + jZ_c \sin \frac{\beta l}{2} I_R$$

در دست خط

$$I_R = 0 \longrightarrow V_m = \frac{V_s}{\cos \frac{\beta l}{2}}$$

گزینہ (1)

تہیہ شدہ توسط:  
علیرضا برمکی و سیامک کریمی

