8-2 每转过一对磁极，磁场变动了一个周期的变化，因此 $n_s = \frac{60f}{p}$

(1) $n=\frac{60f}{p}=\frac{60\times50}{1}\,r/min=3000\,r/min$ (2) $n=\frac{60f}{p}=\frac{60\times50}{16}\,r/min=187.5\,r/min$ (3) $2p=2\cdot\frac{60f}{n}=2\cdot\frac{60\times50}{750}=8$

8-4 由于A相带和X相带电动势和电流方向相反，为避免电动势和电流产生的磁场相互抵消，需反接。

9-4 7次谐波的节距因数 $k_{p7}=\sin(\frac{7y_1}{\tau}\cdot90^\circ)=0$ 即 $y_1=\frac{2}{7}k\tau$

为了不削弱基波，令 $2k=\nu-1=6$ 则 $y_1=\frac{2k}{\nu}\tau=\frac{6}{7}\tau$

10-5 三相合成磁动势基波 $f_1(\theta_s,t)=F_1\cos(\omega t-\theta_s)$

幅值 $F_1=\frac{3}{2}F_{\phi1}=\frac{3}{2}\times0.9\frac{Nk_{w1}}{p}I_\phi=1.35\frac{Nk_{w1}}{p}I_\phi$，取决于匝数$N$，极对数$p$，相电流$I_\phi$和基波绕组因数$k_{w1}$

转向取决于三相电流的相序，转速 $n=\frac{\omega}{p\cdot2\pi}=\frac{60f}{p}$，取决于频率$f$和极对数$p$

谐波磁动势 $f_\nu(x,t)=\frac{1}{\nu}\cdot\frac{3}{2}\cdot\frac{4}{\pi}\cdot\frac{\sqrt{2}}{2}\cdot\frac{Nk_{w\nu}}{p}I\cos(\nu\frac{\pi}{\tau}x-\omega t)$

其中 $\frac{1}{\nu}$ 表示谐波幅值为基波的 $\frac{1}{\nu}$，$\frac{Nk_{w\nu}}{p}$ 表示每相每极下有效串联匝数，I表示相电流。

10-13

(1) $I_{1N}=\frac{S_N}{\sqrt{3}U_N\cos\varphi_N}=\frac{6000}{\sqrt{3}\times6.3\times0.8}A=687.32A$

每极每相槽数 $q=\frac{Q}{2pm}=\frac{36}{2\times3}=6$，槽距电角 $\alpha=\frac{p\times360^\circ}{Q}=10^\circ$ 极距 $\tau=\frac{Q}{2p}=18$

$F_{c1}=0.9I_{1N}=0.9\times687.32A=618.59A$

(2) 每相串联匝数 $N=\frac{Q}{ma}=\frac{36}{3\times1}=12$

基波节距因数 $k_{p1}=\sin(\frac{y_1}{\tau}90^\circ)=\sin(\frac{15}{18}\cdot90^\circ)=0.966$

基波分布因数 $k_{d1}=\frac{\sin\frac{q\alpha}{2}}{q\sin\frac{\alpha}{2}}=\frac{\sin\frac{6}{2}\times10^\circ}{6\times\sin\frac{10^\circ}{2}}=0.956$

基波绕组因数 $k_{w1}=k_{d1}\cdot k_{p1}=0.923$

$F_{\phi1}=0.9\frac{Nk_{w1}}{p}I_\phi=0.9\times\frac{12\times0.923}{1}\times687.32A=6851.48A$

(3) $k_{p5}=\sin(5\frac{y_1}{\tau}90^\circ)=\sin(5\frac{15}{18}\cdot90^\circ)=0.259$

$k_{d5}=\frac{\sin(5\frac{q\alpha}{2})}{q\sin(5\frac{\alpha}{2})}=\frac{\sin(5\frac{6}{2}\cdot10^\circ)}{6\sin(5\frac{1}{2}\cdot10^\circ)}=0.197$

$k_{w5}=k_{p5}k_{d5}=0.051$

$F_{\phi5} = \frac{1}{5} 0.9 \frac{N k_{w5}}{p} I_\phi = \frac{1}{5} \times 0.9 \times \frac{12 \times 0.051}{1} \times 687.32 A = 75.72 A$.

幅值 $F_5 = \frac{3}{2} F_{\phi5} = \frac{3}{2} \times 75.72 A = 113.58 A$.

转速 $n_5 = -\frac{1}{5} n_s = -\frac{1}{5} \frac{60f}{p} = -\frac{1}{5} \times \frac{60 \times 50}{1} = -600 r/min$ 与基波磁动势方向相反

二. 选择题

2. A　　5. C.

三. 判断题

1 ×　　4. ×　　5. √

五. 计算题

2. (1) 极对数 $p = \frac{60f}{n} = \frac{60 \times 50}{1500} = 2$　相数为4

(2) 定子槽数 $Z = 2mpq = 2 \times 3 \times 2 \times 3 = 36$ 槽. 电角度 $\alpha_1 = \frac{p \times 360°}{z} = 20°$

(3) 节距因数:

$k_{p1} = \sin(\frac{y_1}{\tau} \frac{\pi}{2}) = \sin \frac{4}{9}\pi = 0.9848$.　$k_{p3} = \sin 3(\frac{y_1}{\tau} \frac{\pi}{2}) = \sin \frac{4}{3}\pi = -0.866$

$k_{p5} = \sin 5(\frac{y_1}{\tau} \frac{\pi}{2}) = \sin \frac{20}{9}\pi = 0.6428$　$k_{p7} = \sin 7(\frac{y_1}{\tau} \frac{\pi}{2}) = \sin \frac{28}{9}\pi = -0.342$

分布因数:

$k_{d1} = \frac{\sin \frac{q\alpha_1}{2}}{q \sin \frac{\alpha_1}{2}} = \frac{\sin \frac{3}{2} \cdot 20°}{3 \times \sin \frac{1}{2} 20°} = 0.9598$　$k_{d3} = \frac{\sin 3 \cdot \frac{q\alpha_1}{2}}{q \sin 3 \frac{\alpha_1}{2}} = \frac{\sin 3 \cdot \frac{3}{2} \cdot 20°}{3 \sin \frac{3}{2} \cdot 20°} = 0.6667$.

$k_{d5} = \frac{\sin 5 \cdot \frac{q\alpha_1}{2}}{q \sin 5 \frac{\alpha_1}{2}} = \frac{\sin 5 \frac{3}{2} \cdot 20°}{3 \sin \frac{5}{2} \cdot 20°} = 0.2176$.　$k_{d7} = \frac{\sin 7 \cdot \frac{q\alpha_1}{2}}{q \sin 7 \frac{\alpha_1}{2}} = \frac{\sin 7 \cdot \frac{3}{2} \cdot 20°}{3 \sin \frac{7}{2} \cdot 20°} = -0.1774$

绕组因数:

$k_{w1} = k_{p1} k_{d1} = 0.9452$　$k_{w3} = k_{p3} k_{d3} = -0.5774$　$k_{w5} = k_{p5} k_{d5} = 0.1399$.　$k_{w7} = k_{p7} k_{d7} = 0.0607$

(4) $E_{\phi1} = 4.44 f_1 N k_{w1} \Phi_1 = 4.44 \times 50 \times 108 \times 0.9452 \times 1.015 \times 10^{-2} = 230.02 V$

$E_{\phi3} = 4.44 f_3 N k_{w3} \Phi_3 = 4.44 \times 150 \times 108 \times (-0.5774) \times 0.66 \times 10^{-2} = -274.11 V$

$E_{\phi5} = 4.44 f_5 N k_{w5} \Phi_5 = 4.44 \times 250 \times 108 \times 0.1399 \times 0.24 \times 10^{-2} = 40.25 V$

$E_{\phi7} = 4.44 f_7 N k_{w7} \Phi_7 = 4.44 \times 350 \times 108 \times 0.0607 \times 0.09 \times 10^{-2} = 9.169 V$

$E_\phi = \sqrt{E_{\phi1}^2 + E_{\phi3}^2 + E_{\phi5}^2 + E_{\phi7}^2} = \sqrt{(230.02)^2 + (-274.11)^2 + (40.25)^2 + (9.169)^2} = 360.21 V$

由于线电动势中 $E_{\phi3}$ 相互抵消 则

$E_L = \sqrt{3} \sqrt{E_{\phi1}^2 + E_{\phi5}^2 + E_{\phi7}^2} = \sqrt{3} \times \sqrt{(230.02)^2 + (40.25)^2 + (9.169)^2} = 404.77 V$