	Alexandria Higher Institute of Engineering & Technology (AIET)			
	Comunications & Mechatronic Departements		2011/2012	Second Year
	EME 231 & EME 233	Electromechanical Energy Conversion Transformers & Machines		Mid of-Semester-1 Exam, Date 30 / 10 / 2011
	Examiners:	Prof. Dr. Kamel Mohamed Soliman		Time: 1 hour

Question one: (2 marks)

What is the magnetic losses ? How can the eddy-current be made small ? How can the Hysteresis losses be reduced ?

Question two: (2 marks)

Define the residual magnetism and state its advantages and disadvantages .

Question three: (2 marks)

The eddy current losses can be expressed as :

$$P_e = K_e \quad B_m^2 \quad f^2$$

Calculate its value for a coil of 1000 turns supplied by a D C current producing a flux density of 1 Tesla where K_e = 4

Question four: (4 marks)

The magnetic circuit shown in fig. has the following dimensions : A_c = 16 cm^2, l_c = 40 cm and N = 350 turns. The relative permeability of the core is 50000 and the air gap length is 0.2 mm. The coil is connected to a voltage source and the current drawn is adjusted so that the magnetic flux density in the gap is 1.5 T. Neglect the flux fringing,

a-calculate the magnetic flux

b-Find the value of the current

c-Determine the total flux linkage of the coil

Good Luck

Mid-Term exam.
Ideal solution

Q.1: 1- Magnetic losses → 1- eddy current losses
2- Hysteresis losses

2- Eddy current can be made smaller →
By constructing Laminated core

3- Hysteresis losses can be reduced →
By choosing little magnitizing ferrite core

Q.2: Residual magnetism is the natural magnetism remaining in the magnetic material after removing the current affecting it ($H \to 0$)

Advantage: higher residual magnetism means better magnetic material

disadvantages: higher hysteresis losses. i.e. more heating

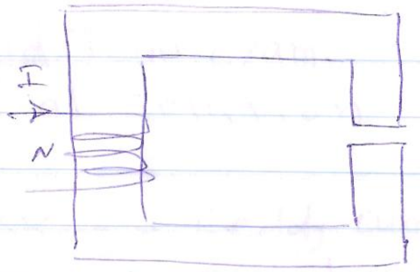
Q.3: $P_e = K_e B_m^2 f^2$

Since current is DC → $f = 0$

$$\boxed{P_e = 0}$$

Q. 4:

Neglecting fringing



$l_g = .2\,mm = 0.0002\,mt$

$A_c = 16\,cm^2 = 16\times10^{-4}\,mt^2$

$l_c = 40\,cm = 0.4\,mmt$

$N = 350$

$\mu_r = 50000$

$B_g = 1.5\,T$

(Φ) (I)

$\therefore A_g = A_c = 16\times10^{-4}$

$\varphi_g = \varphi_c$

a- $\varphi = B.A$

$= 1.5\times16\times10^{-4} = 24\times10^{-4}\,web = 2.4\,m.web$

b- $R_g = \dfrac{l_g}{\mu_0 A} = \dfrac{0.0002}{4\pi\times10^{-7}\times16\times10^{-4}} = 99522.3$

$R_c = \dfrac{l_c}{\mu_0 \mu_r A} = \dfrac{0.4}{4\pi\times10^{-7}\times50000\times16\times10^{-4}}$

$= 3980.9$

$\therefore NI = \sum \varphi R = \varphi_g R_g + \varphi_c R_c$

$350I = 24\times10^{-4}(99522.3+3980.8)$ $\boxed{I = 0.7\,A}$

c- Total flux

$\lambda = N\varphi = 350\times24\times10^{-4} = \boxed{0.84\,web}$