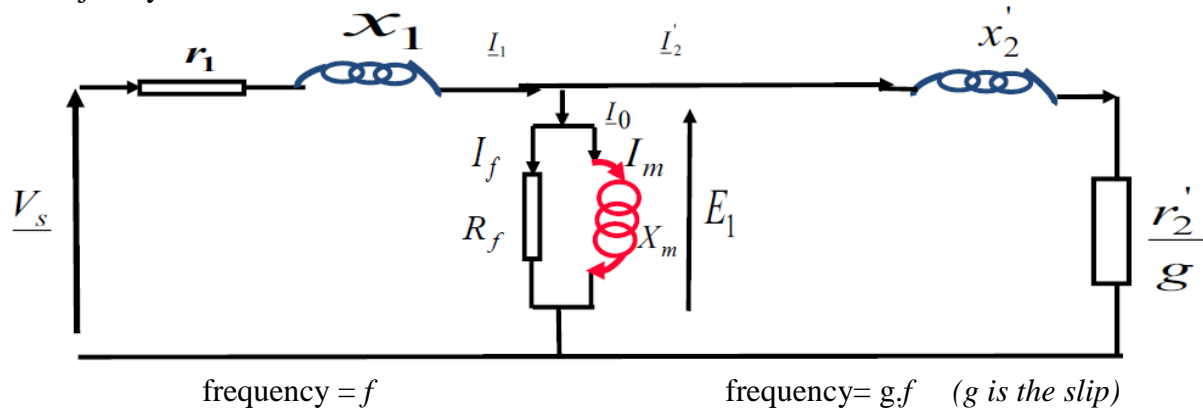## *Exercise: Course question*

Given the simplified scheme of the induction machine per phase and neglecting $(r_1 + jx_1) \times I_1$, prove that the magnetizing current $I_m = \dfrac{V_s}{f} \times \dfrac{1}{2\pi \times L_M}$.

If we want to work at low frequency, are our simplifying assumptions acceptable?
If not justify.

frequency $= f$ frequency= g.f   *(g is the slip)*

Correction

$$\underline{V}_s = (r_1 + jx_1).\underline{I}_1 + \left(\frac{r'_2}{g} + jx'_2\right).\underline{I}'_2$$

The figure above represents the equivalent phase diagram of an induction machine.

The current flowing in the magnetising inductor creates the flux : $L_M = \frac{X_M}{\omega}$.

Optimum engine performance is achieved if the flux, and thus the magnetizing current, is kept substantially constant over the entire speed range. The magnetizing current can be calculated by the expression: $I_M = \frac{E_1}{L_M \omega}$.

With $\underline{E_1} = V_s - (r_1 + jx_1) \times I_1$.

Neglecting $(r_1 + jx_1) \times I_1$, we obtain:

$$I_m = \frac{V_s}{f} \times \frac{1}{2\pi \times L_M}$$

The magnetizing current can therefore be kept constant while keeping the ratio substantially constant. However, at low frequencies and voltages, the term $(r_1 + jx_1) \times I_1$ can no longer be neglected, and in particular the term $r_1 I_1$.

D.A.