MAGNETIC CIRCUITS

Consider a toroidal ring of ferromagnetic material ($\mu > 1$, Iron cobalt and nickel etc).

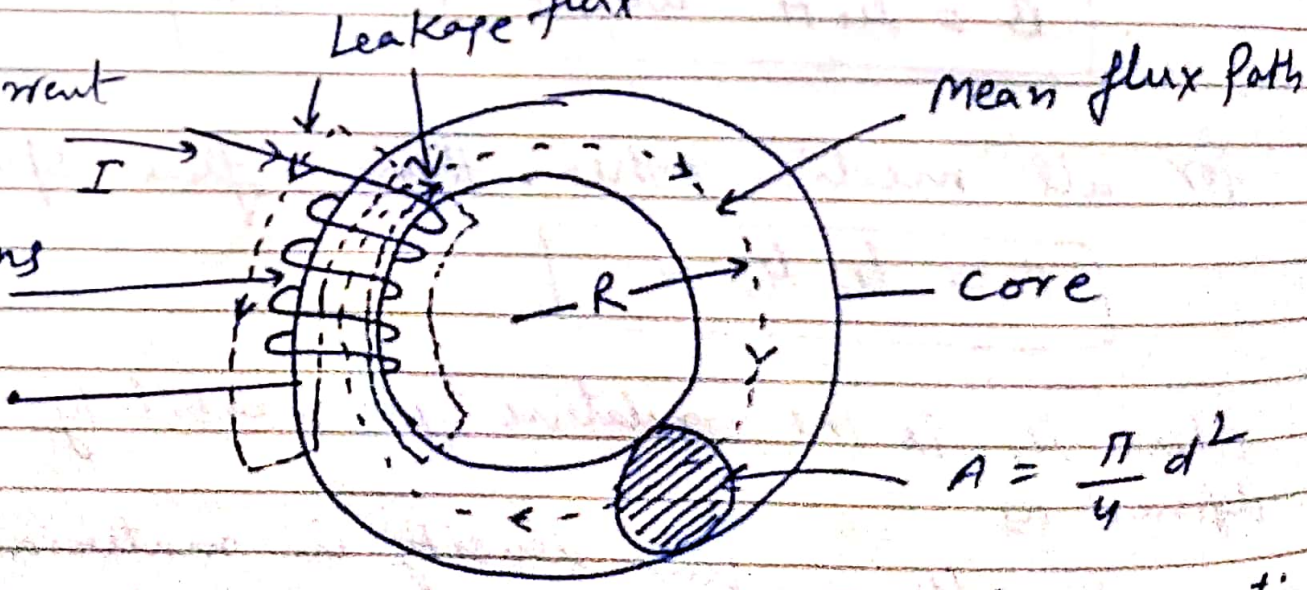

Fig: Toroidal ring of ferromagnetic material with exciting coil

Mean Radius = R
circular cross-section of diameter = d

The ring termed as core is excited by a coil wound round it with N turns carrying a current I.

All the flux lines in the core enclose a current of

$$F_m = NI \quad A-T \quad (\text{Amp. turns})$$

$f_m \rightarrow$ Magnetomotive force which is the causative current (Cause of the existence of a magnetic flux in a magnetic circuit) establishing the flux.

This is known as magnetomotive force S.C.

$F_m \Rightarrow$ magnetomotive force. (mmf)

By symmetry, H in this core is constant round, each flux line and for the mean flux line of radius R, the magnetizing force or (magnetic intensity),

$$H = \frac{NI}{2\pi R} \quad A-T/m = \frac{F_m}{2\pi R} \quad A-T/m$$

$$H = \frac{F_m}{l} \quad A-T/m$$

where l = length of the mean flux path $= 2\pi R$

Notes

Appointment

The mean flux density

$$B = \mu \cdot H$$

$$\therefore B = \frac{\mu \cdot F_m}{l} \quad * \quad Wb/m^2 \text{ or Tesla}$$

$$\phi = A \cdot B = \frac{A \mu \cdot F_m}{l}$$

$$\therefore \phi = \frac{F_m}{\left(\frac{l}{A\mu}\right)} = \frac{F_m}{R} = P F_m$$

where

$$R = \frac{l}{A\mu} \quad A\text{-}T/Wb = \text{reluctance of the magnetic circuit}$$

$$P = \frac{1}{R} = Wb/A\text{-}T = \text{permeance of the magnetic circuit}$$

Difference bet^n EC and MC :→

Electrical circuits	Magnetic circuits
① emf, E (Volt)	mmf, F_m (A-T)
② current, I (Amp)	flux ϕ (Wb)
③ resistance R (Ω)	reluctance R (A-T/Wb) or H$^-$
④ $I = \frac{E}{R} = \frac{emf}{R}$	$\phi = \frac{f_m}{R} = \frac{mmf}{R}$
⑤ $\frac{\rho l}{A}$	$R = \frac{l}{A\mu} = \frac{l}{A \mu_0 \mu_r}$

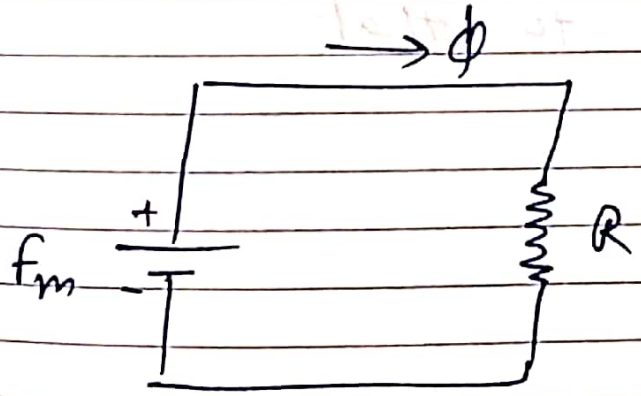

fig. DC circuit analog of magnetic system.

Sunday 11

October'11

Monday	31	3	10	17	24
Tuesday		4	11	18	25
Wednesday		5	12	19	26
Thursday		6	13	20	27
Friday		7	14	21	28
Saturday	1	8	15	22	29
Sunday	2	9	16	23	30