

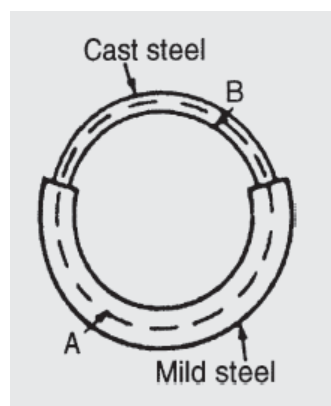
## EEE3352 ASSIGNMENT 3

*(Due in a week's time)*

(Where appropriate, assume  $\mu_0 = 4\pi \times 10^{-7}$  H/m)

1. From the magnetisation curve for mild steel, derive the curve of relative permeability against magnetic field strength. From your graph determine (a) the value of  $\mu_r$  when the magnetic field strength is 1200 A/m, and (b) the value of the magnetic field strength when  $\mu_r$  is 500.
2. A mild steel closed magnetic circuit has a mean length of 75 mm and a cross-sectional area of 320.2 mm<sup>2</sup>. A current of 0.40 A flows in a coil wound uniformly around the circuit and the flux produced is 200  $\mu$ Wb. If the relative permeability of the steel at this value of current is 400, find (a) the reluctance of the material and (b) the number of turns of the coil.
3. Figure Q3 shows a ring formed with two different materials— cast steel and mild steel. The dimensions are in the table below:

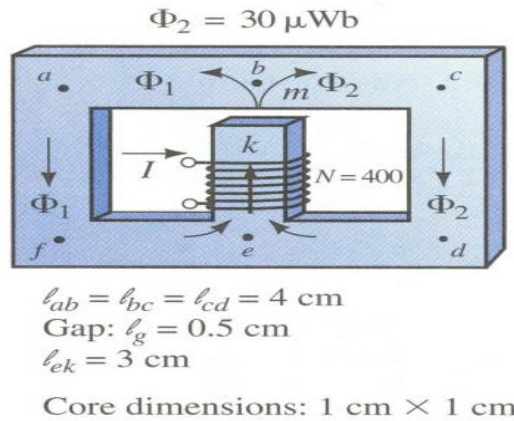
	mean length	cross-sectional area
Mild steel	400 mm	500 mm <sup>2</sup>
Cast steel	300 mm	312.5 mm <sup>2</sup>



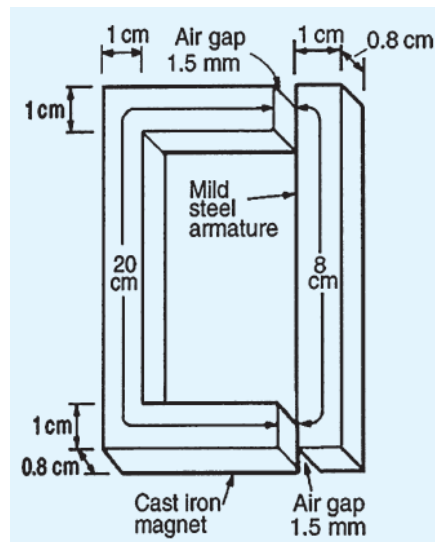
**Figure Q3**

Find the total m.m.f. required to cause a flux of  $500 \mu\text{Wb}$  in the magnetic circuit. Determine also the total circuit reluctance.

4. The core of the magnetic device as shown in the figure below is made of cast-iron and it is symmetrical both left and right arms. Find the current  $I$  that is needed to establish a flux density of  $30 \mu\text{Wb}$  at the right arm of the core.



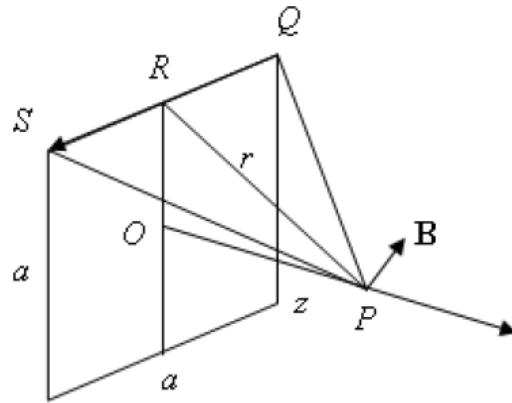
5. Figure Q5 shows the magnetic circuit of a relay. When each of the air gaps are  $1.5 \text{ mm}$  wide, find the m.m.f. required to produce a flux density of  $0.75 \text{ T}$  in the air gaps.



**Figure Q5**

6. A square of side  $a$  carries a current  $I$  as shown in figure Q6. Show that the magnetic flux density at a point on the axis of the coil and distance  $z$  from its plane is given by:

$$B_z = \frac{2\sqrt{2}\mu_0 I}{\pi} \frac{a^2}{(a^2 + 4z^2)\sqrt{a^2 + 2z^2}}$$



**Figure Q6**

**END OF ASSIGNMENT!**