Assignment:1

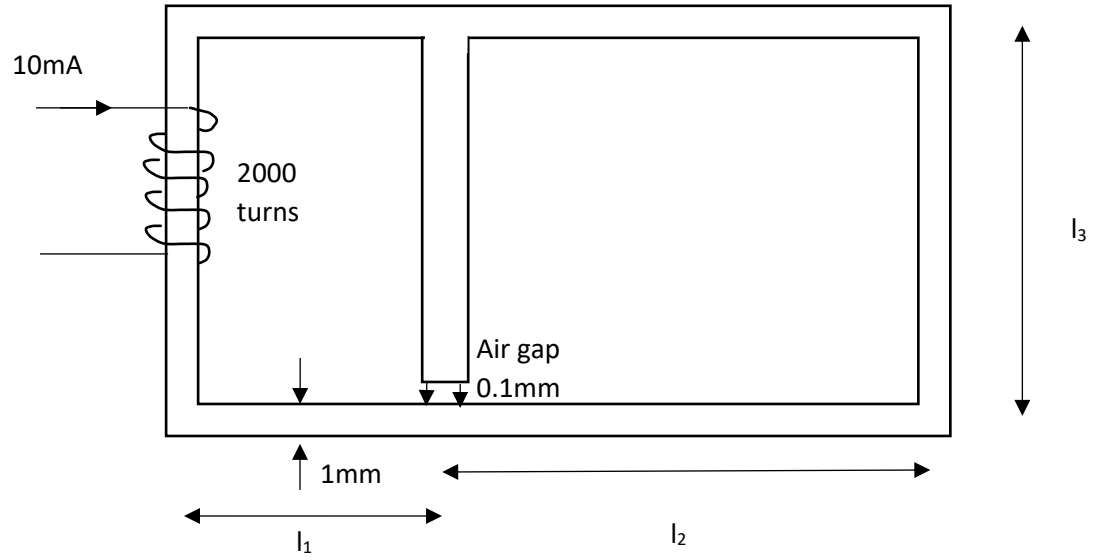
Magnetic Circuits

Note:

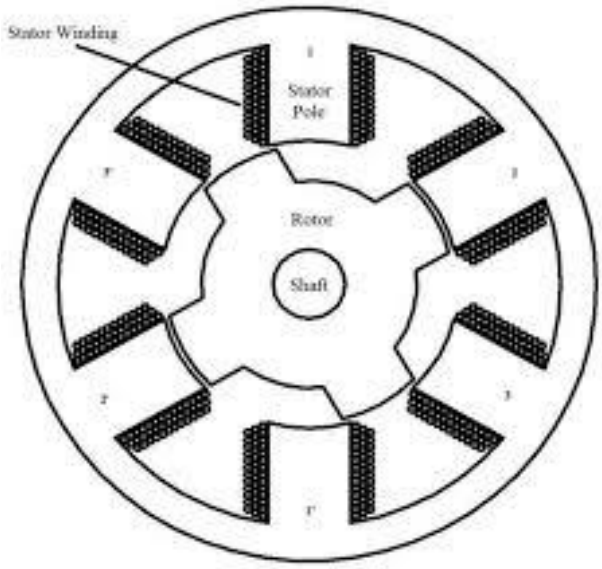
- **Draw the corresponding equivalent electrical circuit for each problem.**
- **Neglect the fringing effect if not mentioned.**
- **The diagrams shown are not to the scale, consider the marking before solving.**

Q1: The core of the magnetic structure is of mean length 40cm and uniform cross sectional are $4cm^2$. The relative permeability of the core material is 1000. An air gap of 1mm is cut in the core and 1000 turns are wound on the core. Determine the inductance of the coil if fringing is negligible.

Q2: Determine the magnetic flux through the air gap in the geometry shown below. The structure is assumed to have a square cross section of area $10^{-6}m^2$, a core with relative permeability 1000, and dimensions l_1=1cm, l_2=3cm and l_3=2cm.

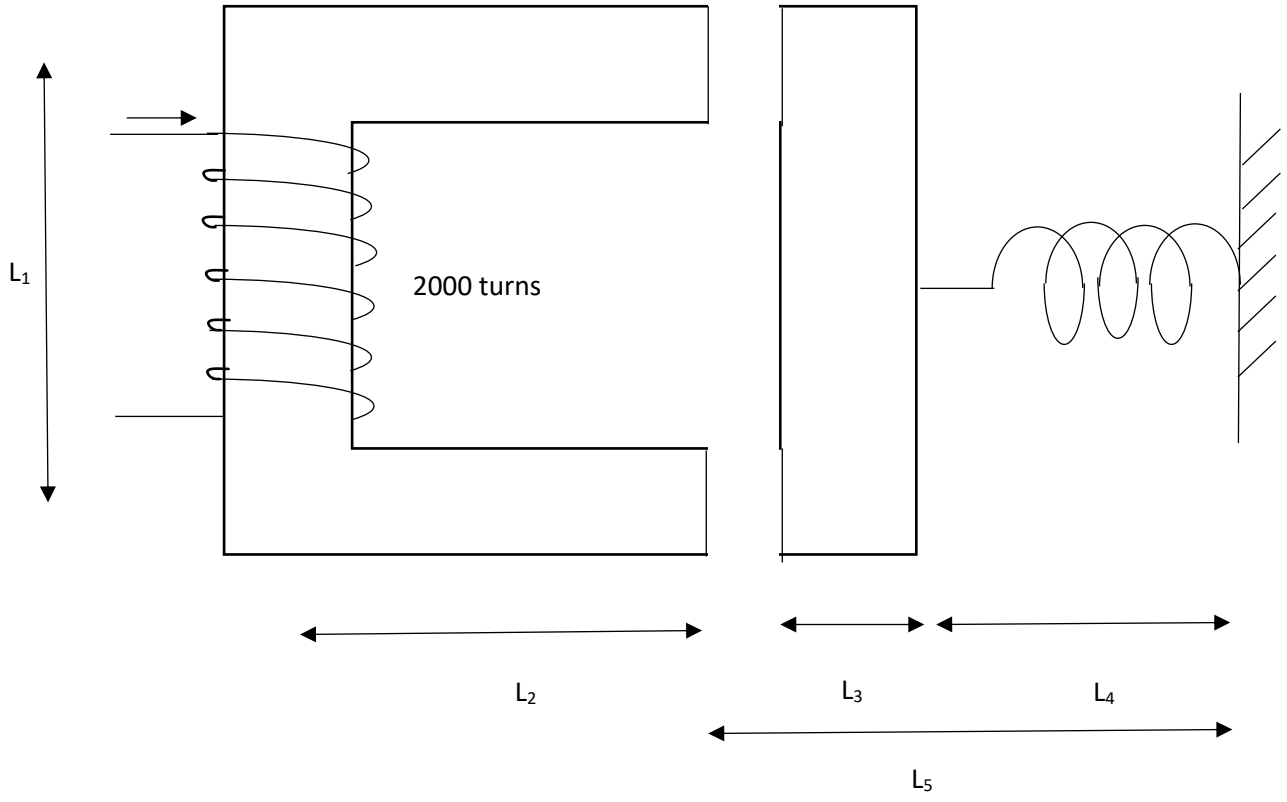


Q3: Switched Reluctance Motor (SRM) is a type of motor that runs by reluctance torque. The torque produced is due to the tendency of the rotor pole to become aligned with the applied magnetic field. The schematic of a 6/4 pole SRM is shown below.

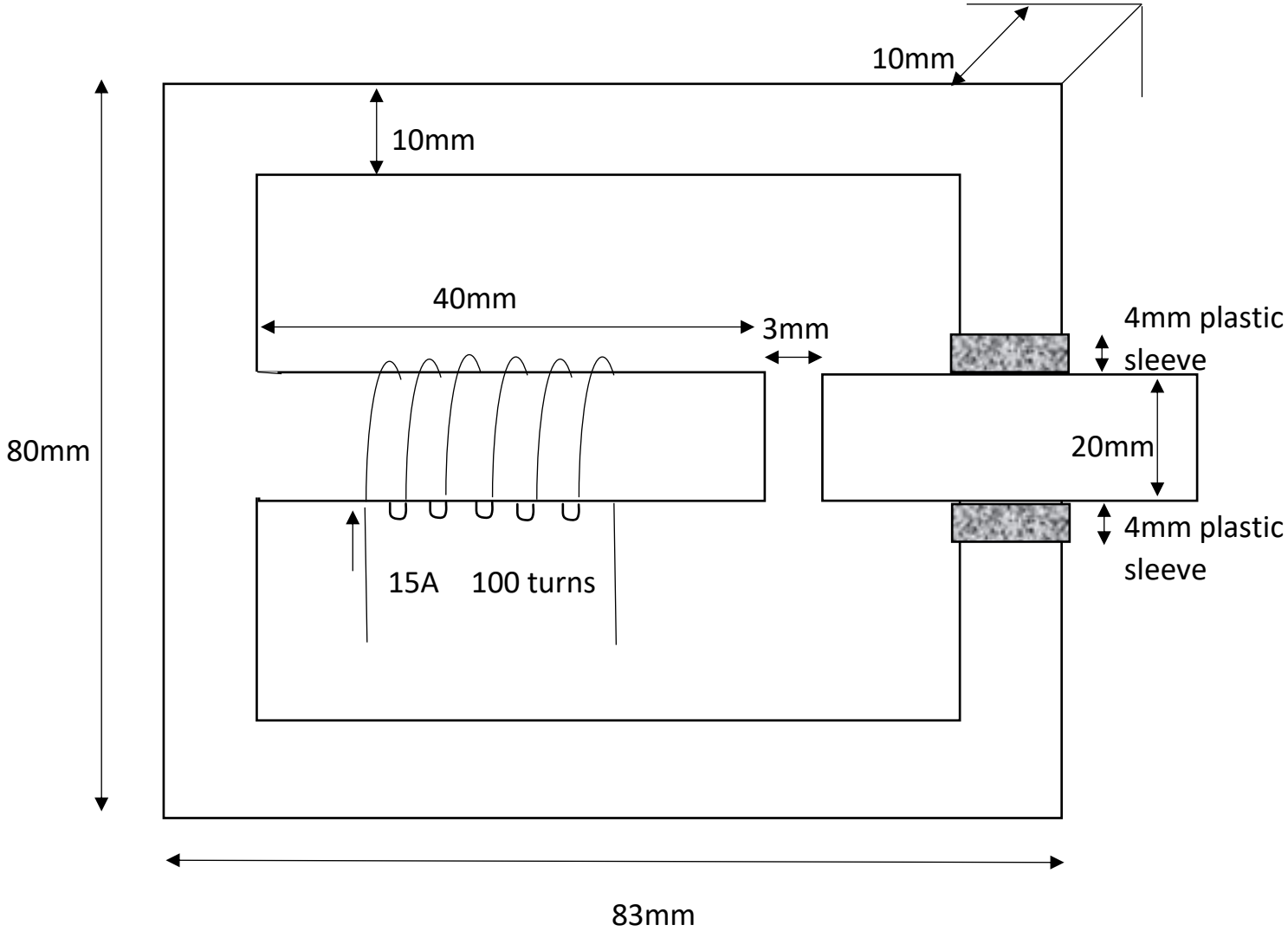


Consider that for each phase there are 500 turns and 2A current. When the rotor poles are fully aligned the air gap between them is 1mm at both sides with negligible fringing. The outer diameter of the stator is 100cm while the inner diameter is 92cm. The rotor length is 80cm. cross sectional area is 400cm^2, and the relative permeability is 5000. Solve the magnetic circuit and find flux in the air gap.

Q4: Consider the structure shown below. The length L_1=22cm, L_2=10cm, L_3=1cm, L_5=14cm and L_4 has maximum extension of 12.9cm and minimum extension of 7cm. The cross-sectional area is 1cm^2 and relative permeability is 5000. Find the air gap flux for both spring lengths, when current is 10A.

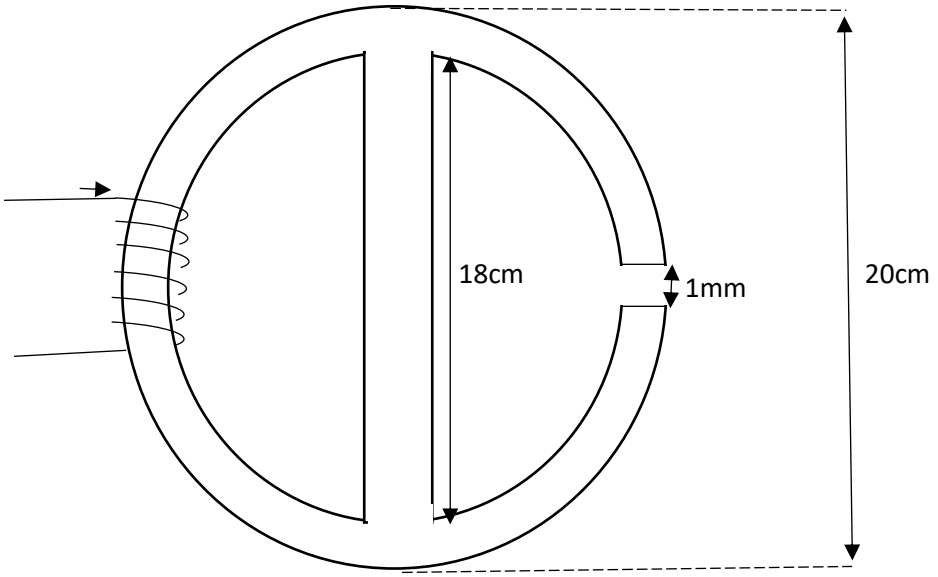


Q5: Find magnetic flux density in the air gap for the given structure when the core is iron.



Q6: Core Type Single Phase Transformer with length, height and cross-sectional area of 33cm, 22cm and 1cm^2 respectively had the relative permeability of core 5000. During the installation the transformer had accidentally been broken with 1mm air gap in the core. The transformer when operated was analysed. The primary winding had input current of 10A with 2000 turns, while the secondary winding had 20A current. If the flux in air gap is 3mWb, find the number of turns of secondary coil.

Q7: Calculate the current in coil to produce a flux density of 1Wb/m^2 in the air gap with 1000 turns. Cross-sectional area of central leg is 0.25cm^2 and magnetic field intensity H=1000.



Q8: Find the amount of current for the following structure when relative permeability is 3000, cross-sectional area is 1cm^2, number of turns are 1000 and magnetic flux density in air gap A is 1.7Wb/m^2.