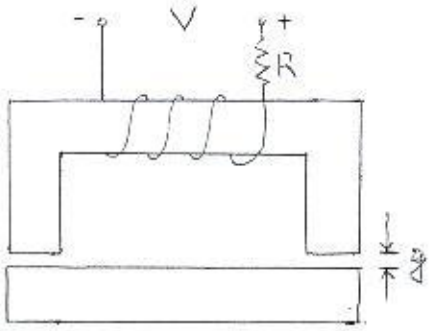
ELETROMECHANICAL ENERGY CONVERSION

1. The electromagnet shown in the figure can be used to lift a sheet of steel. The coil has 400 turns and a resistance of 5 ohms. The reluctance of the magnetic material is negligible. The magnetic core has a square cross section of 5 cm by 5cm. When the sheet of steel is fitted to the electromagnet, air gaps, each of length g = 1 mm, separate them. An average force of 550 N is required to lift the sheet of steel.

a) For dc supply, determine the dc source voltage and the energy stored in the magnetic field.

b) For ac supply of 60Hz, determine the ac source voltage.



2. The rotating machine in the figure has the following parameters:
$L_{ss} = 0.15$ H; $L_{rr} = 0.06$ H; $L_{sr} = 0.08 \cos\theta$ H.

a) The rotor is driven at 3600 rpm. If the stator winding carries a current of 5A (rms) at 60 Hz, determine the instantaneous voltage and rms voltage induced in the rotor coil. Determine the frequency of the rotor induced voltage.

b) Suppose the stator and rotor coils are connected in series and a current of 5A (rms) at 60 Hz is passed through them. Determine the speeds at which the machine will produce an average torque. Also determine the maximum torque that the machine will produce at each speed.