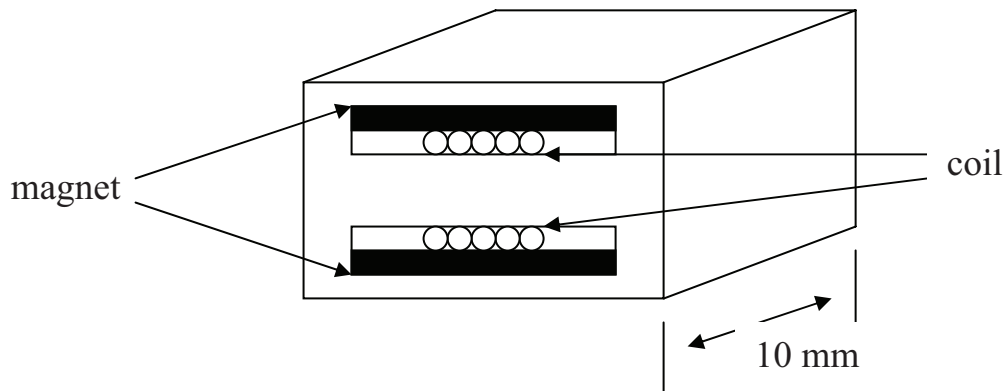## Tutorial Sheet 1.
Voice Coil Actuators

(1.) The principal components and dimensions of a computer hard disc read/write 'voice-coil' actuator are given in figure 1. Two permanent magnets provide a uniform field of 0.6T across the two central slots. A coil which has 150 turns, a resistance of 10 Ω and a self-inductance of 24 mH is located in the slots to provide linear motion.

Find:

      (a) The force constant (Force per Ampere of coil current) of the actuator.
      (b) The voltage constant (Volts per unit of coil velocity)
      (c) The electrical capacitor equivalent of the actuator system given the read/write mechanism has a total effective mass of 3 grams.

(2.) Derive an expression for the impedance of an RLC circuit at a supply frequency of f Hz. Show that the capacitor voltage V_c is given by:

$$V_c = \frac{V_{in}}{\sqrt{\left(1 - \left(2\pi f\right)^2 LC\right)^2 + \left(2\pi f RC\right)^2}} \quad \text{where } V_{in} = \textit{input supply voltage}$$

(3.) The actuator is supplied from a 5V rms, 50Hz voltage source causing the coil to oscillate.

Determine:

  (a) The rms current in the coil
  (b) The peak velocity of the coil
  (c) The maximum peak to peak movement of the coil.