Q 2. A magnetic field of 100 G (1G = 10^{-4}T) is required which is uniform in a region of linear dimension about 10 cm and area of cross section about $10^{-3}m^2$. The maximum current carrying capacity of a given coil of wire is 15 A and the number of turns per unit length that can be wound round a core is at most 1000 turns m^{-1}. Suggest some appropriate design particulars of a solenoid for the required purpose. Assume the core is not ferromagnetic.

Sol. Given, B = 100 G = 10^{-2}T

I = 15 A, n = 1000m^{-1}

Magnetic field inside a solenoid is

$$B = \mu_0 nI$$

$$nI = \frac{B}{\mu_0} = \frac{10^{-2}}{4\pi \times 10^{-7}} = \frac{10^5}{4\pi} = 7955$$

We may have I = 10 A and n = 800

The solenoid may have length 50 cm and cross section $5 \times 10^{-3} m^2$ (five times given values) so as to avoid edge effects etc.