Q 3. A toroid has a core (non ferromagnetic material) of inner radius 25 cm and outer radius 26 cm around which 3500 turns of wire are wound. If the current in the wire is 11 A, what is the magnetic field

   i. outside the toroid
   ii. inside the core of the toroid
   iii. in the empty space surrounded by the toroid?

Sol. Given: $r_1 = 0.25$ m, $r_2 = 0.26$ m, N = 3500, I = 11 A

   i. Outside the toroid, the magnetic field is zero.
   ii. Magnetic field inside the core of the toroid,

   $$B = \mu_0 n I$$
   $$B = \frac{\mu_0 N I}{l} \quad (\because n = \frac{N}{l} \rightarrow \text{Number of turns per unit length})$$
   $$l = 2\pi \left(\frac{r_1 + r_2}{2} \right)$$
   $$= \pi(r_1 + r_2) = \pi(0.25 + 0.26) = \pi \times 0.51 \text{ m}$$

   Putting the values,
   $$B = \frac{(4\pi \times 10^{-7}) \times 3500 \times 11}{\pi \times 0.51} = 3.02 \times 10^{-2} T$$

   iii. In the empty space surrounded by toroid, the magnetic field is zero.