EENG232 ELECTROMAGNETICS

HW1

Date: 14 December 2023 Due: 18 December 2023

1) Find the magnetic flux density due to the given current density everywhere:

$$\bar{J}(r) = \left\{ \begin{array}{ll} \dfrac{4r^2}{\mu_0}, & 1 < r < 2 \\ 0 \quad , & otherwise \end{array} \right\} (A/m^2)$$

2) The magnetic field intensity is given as $\bar{H} = -y\hat{a}_x + x\hat{a}_y (A/m)$ in the z=0 plane. Determine the current density that creates this magnetic field intensity.

3) A solenoid with radius a, length *L* and *N* turns of wire is given. A current of *I* is flowing through the wire. In the core of the solenoid there is a magnetic material of permeability $\mu = \mu_0 \, r \, (H/m)$.

Remembering that the magnetic field intensity within the solenoid is

$$\bar{H} = \frac{IN}{L} \hat{a}_z \ \ (A/m),$$

Determine:

a. the magnetic flux density in the core of the solenoid.
b. the total magnetic flux flowing through the cross-section of the solenoid.
c. the self-inductance of the solenoid for a length *L*.