

Control Number: \_\_\_\_\_

**Department of Electrical and Computer Engineering**  
**Fall 2023 COMPREHENSIVE/BREADTH EXAM**

TTG Area: Power Systems

ECGR 4143 Electrical Machines

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Consider an infinitely long, cylindrical conductor of radius  $R$  carrying a current  $I$  with a *non-uniform* current density  $J = \alpha r^2$ , where  $\alpha$  is a constant and  $r$  is the distance from the center of the cylinder.

- (a) Find the magnetic field everywhere.
- (b) Plot the magnitude of the magnetic field as a function of  $r$ .