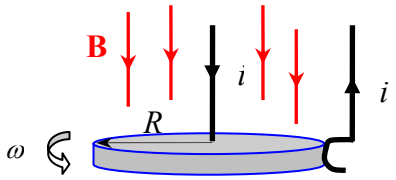
Bilkent University - Physics Department

Phys-112 Electricity & Magnetism

FINAL EXAM

Duration: 120 minutes 18 May 2007

1] (25 pts) A conducting disk of radius R rotates with an angular velocity of ω. There is a uniform magnetic field B perpendicular to the disk. Determine:



a) The emf produced between the center and the outer edge of the disk,

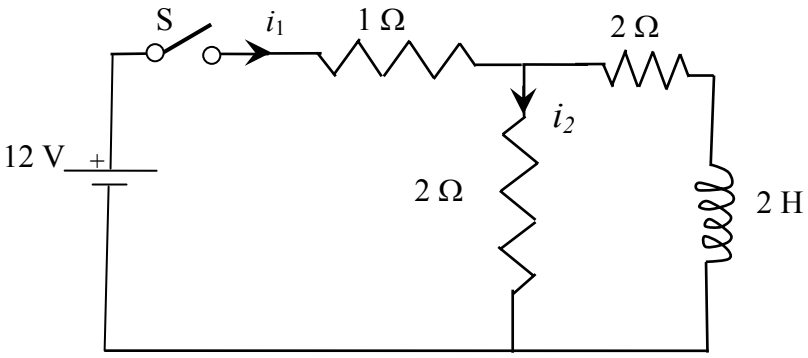
b) The torque that must be provided if the output current is i.

2] (25 pts) An infinitely long coaxial cable consists of two conducting concentric cylindrical shells with radii a and b. There is free-space in the regions: $r<a$, $b>r>a$, and $r>b$. Determine its inductance per unit length.

+5 points BONUS if you determine it using the stored magnetic energy.

3] (25 pts) For the following RL circuit determine the numerical values of i_1 and i_2 **(a)** just after the switch S is closed, **(b)** a long time later; also determine the energy stored in the inductor up to this time, **(c)** just after the switch S is opened again, and **(d)** after a long time later.

Hint: Use the fact that the inductor current should be continuous in time (Faraday's Law)



Get the numerical values correct, no partial credits for this question!

4] Give very brief (a couple of lines) answers for the following questions (5 points each)

a) What is the difference between the magnetic behavior of a diamagnetic and a paramagnetic material?

b) What does the Lenz' law state?

c) What is a mutual inductance?

d) What is the SI unit for magnetic permeability?

e) Why should $\oint_S \vec{B}\cdot\hat{n}da$ vanish for any closed surface S?
