Extra Credit Answers:

Up to 20 extra credit points can be earned by answering some questions listed on WebCT. This document has some figures, etc. that are used in the questions. The geometries for these problems are found in the appendix posted on WebCT that describes the basic configurations for capacitors, inductors and transmission lines.

1. Find the capacitance of a spherical capacitor whose inner radius is 1cm and outer radius is 3cm. The insulating material is Teflon.

   $C = \dfrac{4\pi\varepsilon}{\left(\dfrac{1}{a} - \dfrac{1}{b}\right)}$ C=3.5000e-012 (some wrong answers 1.0619e-010, 5.0569e-011, 1.6667e-012, 2.2301e-010, 7.3500e-012)
2. Find the inductance of a square cross-section torus with 10000 turns of wire tightly wound on a core with $\mu = 2000\mu_o$. The dimensions of the core are width and height equal to 1cm and inner radius equal to 3cm.

   $L = w\dfrac{\mu N^2}{2\pi}\ln\dfrac{a+w}{a}$ L=115.0728 (some wrong answers 1.150728, 9.1572e+007, 0.0575, 11.50728, 0.5750, 9.1572e+005
3. Find the inductance of a circular cross section 1000 turn solenoid wound on a magnetic core with $\mu = 10000\mu_o$. The core radius is 1cm and its length is 10cm.

   $L = \dfrac{\mu N^2 \pi a^2}{l}$ L = 39.4784 (some wrong answers 3.94784, 0.0039, 0.0395, 355.3058, 35.53058)
4. Find the capacitance per unit length of a coaxial cable insulated with Polyethylene. The inner radius of the cable is 1mm and the outer radius is 4mm.

   $\dfrac{C}{l} = \dfrac{2\pi\varepsilon}{\ln\dfrac{b}{a}}$ C/l=9.0168e-011 (some wrong answers 3.3333e-013, 7.5000e-013, 1.4815e-013, 4.0075e-011, 7.9160e-012)
5. Find the capacitance of parallel plate capacitors half insulated with Plexiglass in the configurations shown in the figures in the second row of page 14 of the appendix. The first answer is the one for the left and the second answer is the one for the right. The capacitor plates are $100m^2$ in area and separated by 0.1mm.

   $C = \dfrac{\varepsilon A}{2d} + \dfrac{\varepsilon_o A}{2d}$ C = 1.9452e-005 (some wrong answers 1.9452e-007, 1.9452e-009, 3.0063e-005, 3.0063e-007, 3.0063e-009)

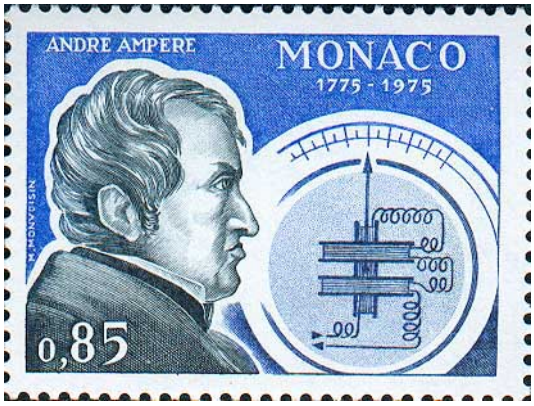
   $\dfrac{1}{C} = \dfrac{d/2}{\varepsilon A} + \dfrac{d/2}{\varepsilon_o A} = \dfrac{d}{2A}\left(\dfrac{1}{\varepsilon} + \dfrac{1}{\varepsilon_o}\right)$ C = 1.3665e-005 (some wrong answers 7.3181e+016, C = 3.4162e-008, C = 3.4162e-010, 7.3181e+011)
6. Find the capacitance of the spherical capacitor of question 1 half insulated with Plexiglass as shown in the figure at the bottom of page 16 of the appendix.

C=3.6667e-012 (some wrong answers 1.6667e-012, 1.1125e-010, 3.2721e-011, 9.6238e-012)

7. Find the inductance per unit length for a coaxial cable where the center conductor is made by depositing copper in a very thin layer on a non-conducting magnetic wire with a permeability of $\mu = 100\mu_o$. The center conductor has a radius of 1mm and the outer conductor has a radius of 4mm.

   $\frac{L}{l} = \frac{\mu_o}{2\pi}\ln\frac{b}{a}$ L = 2.7726e-007 (some wrong answers 3.2726e-005, 5.0000e-006, 5.2773e-006, 2.7726e-005, 3.2726e-007) The internal inductance (inside the center) has no effect since there is no field there.

8. Which name goes with which photo? (Blackout of names is removed)



(a) Ampere

(b) Maxwell

(c) Faraday

(d) Gauss

(e) What famous US Scientist is pictured on US currency? Franklin (could also be Jefferson)

Two of the scientists featured on the stamps above were also found on currencies no longer in use now that Europe has adopted the Euro. Who are these two scientists?

(f) Faraday

(g) Gauss