Final Exam. (Winter 2017), General Phys. , CS152.

[The sum of all points is 121, the exam score is 100 points if the sum of all points is greater than 100]

1. Define/explain/describe the following items (using figures/equations if necessary),   (30 pts)

    (a)Coulomb's law, (b)Electric field, (c) Gauss's law for electric field, (d)Magnetic force,

    (e)Biot-Savart Law, (f) Ampere's law, (g)Gauss's law for magnetic field, (h)Faraday's law,

    (i) Huygens' Principle, (j) Total internal reflection.

2. An electron close to a large, flat sheet of charge is repelled from the sheet with a 1.8-pN force. Find the surface charge density on the sheet. (8 pts)

3. How much work does it take to move a 35-μC charge against a 12-V potential difference? (8 pts)

4. A capacitor consists of square conducting plates 25 cm on a side and 5 mm apart, with the upper plate carrying charges +1.1 μC. Find (a) the charges on the lower plate, (b) the potential difference V between the plates, (c) the electric field E, (d) the stored energy U, and (e) the ratio of U to $\varepsilon_0 E^2/2$. (the capacitance of a parallel-plate $C = \varepsilon_0 A/d$).   (25 pts)

5. A wire of negligible resistance is bent into a rectangle as in Fig. 1, and a battery and resistor are connected as shown. The right-hand side of the circuit extends into a region containing a uniform 38-mT magnet field pointing into the page. Find the magnitude and direction of the net force on the circuit. (8 pts)
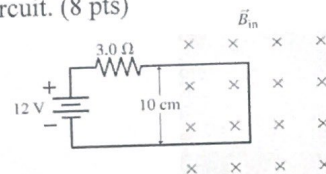
6. A conducting loop of area 230 cm^2 and resistance 14 Ω is perpendicular to a spatially uniform magnetic field and carries a 350-mA induced current. At what rate is the magnetic field changing? (8 pts)

Figure 1

7.In Figure 2, as the particles of different charge enter the magnetic fields, please tell

    (a) which way would proton go? ↗

    (b) which way would electron go? and ↙

    (c) which way would neutron go?   (left-hand, right-hand side or straight) (6 pts)
                straight

8.For the production of electric and magnetic fields, please describe what the sources are for :

    (a) static E fields, (b)induced E fields, (c) static B fields, and (d) induced B fields?   (8 pts)

Figure 2

9.Which law can explain Diamagnetism? (Ampere's law, Gauss's law or Lenz's law) (2 pts)

10. In high-quality optical systems, what is the limiting factor preventing perfect sharp image formation?

        (Reflection, Refraction, or Diffraction)   (2 pts)

11.Regarding electromagnetic theory,

    (a) please write down the Maxwell's Equations,(8 pts)

    (b) what is the speed of electromagnetic wave in vacuum, (2 pts)

    (c)which direction will an EM wave propagate if its electric field is in the +x direction and its magnetic field in the +y direction? (2 pts)

    (d) what kind of charge motion will produce EM waves? (static, uniform or accelerated) (2 pts)

    (e) radio-waves, micro-wave, infrared, visible light, X-rays and Gamma rays are all examples of EM waves, what is the difference among them? (2 pts)

[$\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/N·m^2, $k = 9.0 \times 10^9$ N·m^2/ C^2, +e = 1.6×10^{-19} C, electron mass = 9.11×10^{-31} kg, $\mu_0 = 4\pi \times 10^{-7}$ N/A^2]