Physics 3201
Problem Set 10

Due: Thursday, November 7. Solutions will be posted at mid-day on Friday, Nov. 8.

Notes: This problem set covers Sections 3.4 and chapter 4 up through Sectioni 4.4.1. You should be reading all of Chapter 4 and the first section of Chapter 5.

Exam 2: The second exam will be on Tuesday, Nov. 12. It will cover chapters 1–4 of Griffiths, through the material in this problem set, with an emphasis on Chapters 3–4. You will be permitted to bring a single page of notes, and copies of the front and back covers of Griffiths will also be provided.

1. Griffiths, Problem 3.34 (Problem 3.32 in 3rd Ed.).

2. Problem 3.35 (new in 4th Ed.).

3. Problem 4.15.

4. Problem 4.16. This can be done either by using the hint, or by using the continuity conditions for the fields.

5. A large parallel-plate capacitor is filled with an inhomogneous dielectric with a permittivity that varies linearly from one plate to the other,

$$\varepsilon = \varepsilon_0 (1 + bz),$$

   where z is the distance from the bottom plate. The potential difference between the plates is V_0 and they are separated by distance d. Find the field $E(z)$, the potential $V(z)$, the polarization volume charge density $\rho_b(z)$, and the polarization surface charge density at the surfaces of the dielectric adjacent to the plates. If the area of the plates is A, what is the capacitance C of this device?

6. Problem 4.20. Note that you will have to find the electric field both outside the sphere and within it before you can evaluate the potential.

Honors: Problem 4.32 (new to 4th Ed.). You can use the result of problem 3.4 without proving it, although if you would like to prove this too, it's sort of interesting. If you do, consider using Mathematica for the integral, which is unpleasantly complicated. The next meeting of honors students will be on Friday, November 8, at 1:30 PM in room P302S.