PHY 4241/5227 : Advanced Dynamics, Spring 2007

April 13^{th}, 2007

Assignment # 13

(due Friday April 20^{th}, 2007, at the beginning of class)

1. Problem 12.59 of Griffith's book.

2. Problem 12.46 of Griffith's book.

3. Problem 12.50 of Griffith's book.

4. An electron (of charge e) is traveling at a constant velocity $\mathbf{v} = v\hat{\boldsymbol{x}}$ along the x-axis with respect to the laboratory frame. You may assume that at time $t=0$ the electron passes through the origin of the laboratory frame.

4.a) Compute the electric field $\mathbf{E}'(\mathbf{r}', t')$ and the magnetic field $\mathbf{B}'(\mathbf{r}', t')$ in the rest frame of the electron, *i.e.*, as measured by an observer in an inertial frame traveling with the electron.

4.b) From the above configuration of fields, construct the electromagnetic field tensor $F'_{\mu\nu}(\mathbf{r}', t')$ as measured by an observer in an inertial frame moving with the electron.

4.c) Use the appropriate Lorentz transformation on the electromagnetic field tensor to extract the electric field $\mathbf{E}(\mathbf{r_0}, t)$ and the magnetic field $\mathbf{B}(\mathbf{r_0}, t)$ measured by an observer in the laboratory frame located at the point $\mathbf{r_0} = (0, y_0, 0)$.