Physics 385
Electromagnetism

Fall 2007 - Prof. Bartynski

Exam II

Friday, 16-November-2007
1:40 PM – 3:00 PM

Closed Book. Closed Notes.
Calculator OK, Two Cheat Sheets OK.

Do not open this exam until instructed to do so.
Please fill out the information on the cover of your blue book.
Answer all 4 problems.

Possibly useful information:

$$P_o(\cos\theta)=1;\ P_1(\cos\theta)=\cos\theta;\ P_2(\cos\theta)=\tfrac{1}{2}(3\cos^2\theta-1);\ P_3(\cos\theta)=\tfrac{1}{2}(5\cos^3\theta-3\cos\theta)$$

$$\int_0^{\pi} P_l(\cos\theta)P_{l'}(\cos\theta)\sin\theta d\theta=\tfrac{2}{2l+1}\delta_{l,l'}\quad;\quad \int_0^{a}\sin(n\pi x/a)\sin(n'\pi x/a)dx=\tfrac{a}{2}\delta_{n,n'}$$

$$\cos 2\theta=(2\cos^2\theta-1)\quad;\quad \sin^3\theta=\tfrac{3}{4}\sin\theta-\tfrac{1}{4}\sin(3\theta)\quad;\quad \int_0^{\infty} r^n e^{-\alpha r}dr=\tfrac{n!}{\alpha^{n+1}}$$

$$\int\frac{dx}{(x^2+a^2)^{\frac{1}{2}}}=\ln[x+(x^2+a^2)^{\frac{1}{2}}] \qquad \int\frac{xdx}{(x^2+a^2)^{\frac{1}{2}}}=(x^2+a^2)^{\frac{1}{2}}$$

$$\int\frac{x^2dx}{(x^2+a^2)^{\frac{1}{2}}}=\tfrac{x}{2}(x^2+a^2)^{\frac{1}{2}}-\tfrac{a^2}{2}\ln[x+(x^2+a^2)^{\frac{1}{2}}] \qquad \int\frac{x^3dx}{(x^2+a^2)^{\frac{1}{2}}}=\tfrac{1}{3}(x^2+a^2)^{\frac{1}{2}}-a^2(x^2+a^2)^{\frac{1}{2}}$$

$$\int\frac{dx}{(x^2+a^2)^{\frac{3}{2}}}=\frac{x}{a^2(x^2+a^2)^{\frac{1}{2}}} \qquad \int\frac{xdx}{(x^2+a^2)^{\frac{3}{2}}}=\frac{-1}{(x^2+a^2)^{\frac{1}{2}}}$$

$$\int\frac{x^2dx}{(x^2+a^2)^{\frac{3}{2}}}=\frac{-x}{(x^2+a^2)^{\frac{1}{2}}}+\ln[x+(x^2+a^2)^{\frac{1}{2}}] \qquad \int\frac{x^3dx}{(x^2+a^2)^{\frac{3}{2}}}=(x^2+a^2)^{\frac{1}{2}}+\frac{a^2}{(x^2+a^2)^{\frac{1}{2}}}$$

Binomial expansion: $(1+x)^n=1+nx+\frac{n(n-1)}{2!}x^2+\ldots$ where $x^2<1$

Some useful constants: $e = 1.6 \times 10^{-19}$ C; $\varepsilon_o = 8.85 \times 10^{-12}$ C^2/Nm^2