PHYS 411 (Fall 2013): Electricity and Magnetism
Final exam: Monday, December 16, 8.00-10.00 am.

Read the instructions below and do *not* flip to next page till you are told to do so.

Name:

Student ID:

Useful formulae:

$q' = -\frac{R}{a}q$	$b = \frac{R^2}{a}$	$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$
$\mathbf{F} = Q(\mathbf{v} \times \mathbf{B})$	$V(\bar{r}) = -\int_{\mathcal{O}}^{\bar{r}} \mathbf{E}.d\mathbf{l}$	$\nabla.\mathbf{E} = \frac{\rho}{\epsilon_0}$
$\mathbf{F} = \frac{1}{4\pi\epsilon_0}\frac{qQ}{\boldsymbol{\mathscr{r}}^2}\hat{\boldsymbol{\mathscr{r}}}$	$\mathbf{P} = \epsilon_0 \chi_e \mathbf{E}$	$\int \mathbf{E}.d\mathbf{a} = \frac{Q_{enc}}{\epsilon_0}$
$\mathbf{E}_{above} - \mathbf{E}_{below} = \frac{\sigma}{\epsilon_0}\hat{\mathbf{n}}$	$d\tau = s\ ds\ d\phi\ dz$	$\mathbf{B} = \frac{\mu_0 I}{4\pi}\int \frac{d\mathbf{l}' \times \hat{\boldsymbol{\mathscr{r}}}}{\mathscr{r}^2}$
$\int \mathbf{B}.d\mathbf{l} = \mu_o I_{enc}$	$V = IR$	$\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$
$\mathcal{E} = -d\phi/dt$	$\phi = \int \mathbf{B}.d\mathbf{a}$	$\phi = LI$
$B = \mu_0 n I$	$\int \mathbf{D}.d\mathbf{a} = Q_{f enc}$	$\hat{\mathbf{s}} \times \hat{\phi} = \hat{\mathbf{z}}$
$d\mathbf{a} = s\ ds\ d\phi\ \hat{\mathbf{z}}$	$\mathbf{B}_{above} - \mathbf{B}_{below} = \mu_o (\mathbf{K} \times \hat{\mathbf{n}})$	$I_{enc} = \int \mathbf{J}.d\mathbf{a}$
$\mathbf{S} = \frac{1}{\mu_0}(\mathbf{E} \times \mathbf{B})$	$\mathbf{D} = \epsilon_0 \mathbf{E} + \mathbf{P}$	$d\mathbf{a} = s\ d\phi\ dz\ \hat{s}$
$\nabla.\mathbf{D} = \rho_f$	$P = \frac{\mu_0 \ddot{p}^2}{6\pi c}$	$\mathbf{p}(t) = \int \mathbf{r}' \rho(\mathbf{r}', t)\, d\tau'$
$\sigma_b = \mathbf{P}.\hat{\mathbf{n}}$	$\rho_b = -\nabla.\mathbf{P}$	$Q = CV$
$\mathbf{K}_b = \mathbf{M} \times \hat{\mathbf{n}}$	$\mathbf{J}_b = \nabla \times \mathbf{M}$	$\int \mathbf{H}.d\mathbf{l} = I_{f\ enc}$
$\mathbf{M} = \chi_m \mathbf{H}$	$\mathbf{B} = \mu_0 (1 + \chi_m) \mathbf{H}$	$\nabla \times \mathbf{H} = \mathbf{J}_f$
$s = ut + \frac{1}{2}at^2$	$U = mgh$	$\hat{\mathbf{z}} \times \hat{\mathbf{s}} = \hat{\phi}$

It is necessary to show the *details* of the derivation and not just the final answer for *all* problems.

This is a closed book exam and any other forumla sheets/notes are not allowed.

Please write clearly and if you use the backside of a page, then please indicate so.

Check that there are total of 7 printed pages (6 problems and this page) + 2 blank pages following problems 3 and 5.

Remember the honor pledge that you signed at the start of the semester.

Problem #	Points scored	Maximum points
1		6
2		13
3		15
4		12
5		9
6		10
Total		65