PHY 501: Electromagnetic Theory

Chan La-o-vorakiat

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- Instructor: Chan La-o-vorakiat
  Tel: 9562
  email: chan.lao@kmutt.ac.th
- Class meets at SCI 500, KMUTT, Bangmod, Tuesday 12.30-15.30
- **Grading:** Paper Homework 35%, Numerical Homework 15%, Participation 10%, Final Exam 40%.
- **Homework:** three homework sets for this second half. Homework problems will be issued in class and due two weeks later.
- **Two Types of Homework:** a paper-based one and a numerical one to be done with Python and submit via email. Both must be submitted before the due date. No late homework will be accepted since the solution will be available on the due date. But emergency exceptions could be made based on case-by-case basis.
- **Numerical Homework:** if I ask you to create some plots from the numerical homework, you must identify yourself by putting your name and your student ID as the title of the plot, and then you can submit the image files via email. The code for making title is

  ```
  plt.tltle("Your Name ID:4505043")
  ```

  If the homework requires only your text response, simply type it down into your email messsage.
- **Office hours:** Monday 9–10 a.m. at my office (5^{th} floor further from the microbiology offices) or by appointment
- **Class repo:** https://github.com/laovorak/PHY501 Where you can find the lecture notes and the ipython notebooks for your homework.
- **Materials:**

  1. Magnetostatics and electrodynamics (Week 11-12)
     - Current
     - Magnetic Induction and Biod-Savart Law
     - Ampere's Law
     - Vector Potential
     - Lorentz Force

- Electromotive Force and Flux Rule
- Faraday's Law
- Maxwell's Displacment Current
- Maxwell's Equations

2. Magnetic Field and Introduction to Magnetism (Week 13-14)
   - Multipole Expansion
   - Magnetization
   - Fields due to Magnetization
   - Magnetic Field
   - Magnetic Charge
   - Maxwell's Equations inside Materials
   - Demagnetized Field and Stray Field
   - Magnetic Susceptibility
   - Origins of Magnetization
   - Magnetization Dynamics and Landau-Lifshitz-Gilbert Equation
3. Electromagnetic Wave and Applications (Week 15-16)
   - Poynting Vection and Energy in the Field
   - Electromagnetic Wave
   - Energy, Intensity and Power
   - Electromagnetic Wave inside Matter
   - Electromagnetic Wave and Interface
   - Conductivity Models
   - Special Relativity

- Textbooks:

1. D. Griffiths, Introduction to Electrodynamics, 4th edition, Pearson, 2013.
2. J. M. D. Coey, Magnetism and Magnetic Materials, Cambridge, 2010. (used when discussing magnetism)
3. **Others:** J. D. Jackson, Classical Electrodynamics, 3rd edition, Wiley 1998.
4. A. Zangwill, Modern Electrodynamics, Cambridge, 2012.

- **Python installation** The easiest way is to install the entire Anaconda package.

1. Go to `http://continuum.io/downloads`
2. Download the installers based on your operating system. **BUT PLEASE INSTALL PYTHON VERSION 2.7 ONLY. DO NOT USE PYTHON 3.4.**. So your only options are
   (1) Windows 64(32)-Bit Python 3.4 Graphical Installer
   (2) Mac Os X – 64(32)-Bit Python 2.7 Graphical Installer
   (3) Linux 64(32)-Bit – Python 2.7.
3. Follow the screen command

4. Lanuch ipython notebook from the created shortcut or
   (Windows) Start Menu → Anaconda (64-bit) → IPython (Py2.7) Notebook
   (Mac OsX) Launch Terminal (Applications → Terminal). Then type

   ```
   $ ipython notebook
   ```

5. New → Python 2 notebook.

6. New → Python 2 notebook.
7. Try to hello the world by typing

   ```
   print "Hello World"
   ```

   and shift + enter to execute the line (just like Mathematica notebook).