

PHY102 Electricity

Introduction

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Timetable: Mondays 10:00 Hicks Building LT07 } Weeks 1 to 6 of Semester 2
Fridays 10:00 Diamond LT05 }

Electricity is the first part of your First Year course on electromagnetism, which will be continued in the second half of the semester. This part of the course deals with electrostatics and simple electric circuits. (The second part deals with magnetism and electromagnetism.)

A key aspect of the First Year Physics course as a whole is the application of appropriate mathematical techniques to physical situations. You will probably find that the qualitative descriptions used in this topic are relatively straight forward – it is when quantitative calculations are performed that the material becomes challenging! Make sure that you read the Background Mathematics sheet, and try all the examples included in this booklet.

Text Book:

This course, along with other first year Physics lectures, uses the common course textbook:

Young and Freedman "University Physics with Modern Physics" 13th edition, ISBN 0-8053-8684-X, published by Pearson Addison-Wesley.

Chapters from this book are recommended as supplementary material to the course. Each topic presented in these notes has reading material listed. You are strongly urged to read these chapters, preferably before the lectures covering the material. Problems from the book are also recommended for each lecture topic.

(Note that all references to chapters, sections and problems refer to the 13th edition. Similar material is covered in earlier editions, but some of the references will be different.)

Web page:

<http://www.cbooth.staff.shef.ac.uk/phy102Elec/>

(also linked from the PHY102 MOLE page and the Departmental module list.)

Syllabus

Topic 1 – Electrostatics: Electric charge. Conductors, insulators and induction. Coulomb's Law. The principle of superposition.

Topic 2 – Electric Fields: Field lines. Electric fields and conductors. Electric dipoles in an electric field.

Topic 3 – Gauss's Law: Electric flux. Gauss's Law, the relationship between flux and enclosed charge. Electric fields and conductors revisited.

Topic 4 – Electrostatic Potential: Potential energy of a charge and electrostatic potential. Potential of point and spherical distributions. Deriving electric fields from potentials. The potential energy of systems of charges and charge distributions.

Topic 5 – Capacitors and Dielectrics: Capacitors and capacitance. Combinations of capacitors in series and parallel. The energy stored in a capacitor. Dielectric materials.

Topic 6 – Resistance and Resistivity: Current and resistance. Current in a wire. Resistivity. Ohm's Law. The Drude Model of conduction.

Topic 7 – Electric Circuits: Electromotive force. Kirchhoff's rules. Combinations of resistors. Time dependence in RC circuits.

Revision Session

Past Examination Papers

Specimen exam papers for the course from the last three years are available from the departmental web page, while feedback on previous performance and numerical answers are available from my PHY102Elec web page.