Overview
This module provides a basic grounding in practical electronics. It introduces and develops the basic principles underlying the synthesis and analysis of analogue circuits. The module is divided into two parts: passive circuits, beginning with a review of dc circuit theory before moving onto complex impedance, passive ac circuits and diode applications; active circuits and amplifiers, including simple bipolar and FET amplifiers, operational and instrumentation amplifiers and applications.

Aims & Objectives
The aim of the course is to provide a grounding in the basic principles behind practical electronics that will be useful for any student undertaking experimental physics.

Learning Outcomes
By the end of the course students will be expected to:

1) be familiar with and proficient in using methods to calculate the voltages and currents in complex linear circuits containing voltage sources, current sources and resistors and be able to calculate Thevenin and Norton equivalent circuits and explain and apply the concepts and importance of input and output impedance.

2) be familiar with and proficient in using methods to solve simple ac circuits containing resistors, capacitors and inductors using complex representations. They should be able to explain how simple integrators, differentiators, filters and timing circuits are made using combinations of resistors, capacitors and inductors and design examples.

3) be able to solve simple circuits containing non-linear devices and apply appropriate diode models to common applications, including their use in power supplies and voltage references.

4) explain the principles of and design basic transistor circuits and be able to calculate quantities such as gain and input and output impedance for both bipolar and FET transistors. They should know the relative advantages and disadvantages of both bipolar transistors and FET transistors for amplifier circuits and be able to explain the differences between, and relative merits of, Class A, Class B and Class AB amplifiers.

5) be able to design and analyse circuits using operational amplifiers and explain how they can be used in a variety of applications. They should also clearly understand the advantages and limitations of operational amplifiers and be able to explain the behaviour of circuits using operational amplifiers.

6) In the lab, be able to construct, test, debug and explain the operation of simple electronic circuits using standard components.

Synopsis

Pre-requisites
PH2011, PH2012, MT2001 or (MT2501 and MT2503)
Anti-requisites
None

Assessment
Continuous Assessment (Tutorial exercises 12.5%, Laboratory 12.5%) = 25%, 2 Hour Examination = 75%

Additional information on continuous assessment etc
Please note that the definitive comments on continuous assessment will be communicated within the module. This section is intended to give an indication of the likely breakdown and timing of the continuous assessment.

There will be four combined laboratory and tutorial sets for this module, with the laboratory work undertaken in weekly one-hour sessions that will run in weeks 2 to 5 and weeks 7 to 11. The submission dates for these exercises are expected to be in weeks 4, 9, 9 and 11. The work will be marked and returned with individual written feedback. These four submissions will together contribute 25% of the overall module grade.

Accreditation Matters
This module may not contain material that is part of the IOP “Core of Physics”, but does contribute to the wider and deeper learning expected in an accredited degree programme. The skills developed in this module, and others, contribute towards the requirements of the IOP “Graduate Skill Base”.

Recommended Books
Please view University online record:
http://resourcelists.st-andrews.ac.uk/modules/ph3074.html

General Information
Please also read the general information in the School’s honours handbook.