# Physics 3108 Lab 5: LEDs & Lasers

**Background**
At this point you should have a functional, computer controlled current source with the ability to measure the corresponding voltage. You will also have built a photoreceiver that converts light into voltage. You will also need to have demonstrated an understanding of laser safety before receiving the laser diode for characterisation.

**Purpose**
To characterise the LIV (Light, Current, Voltage) properties of a red laser and multiple different colours of LEDs.

**Pre-Lab (week 1)**
Using the spec sheet for the red laser (on the web site), calculate the MPE, AEL and NOHD for this laser for two conditions: a) lab use, b) full Class 1 safe operation. This will need to be calculated correctly before you are given your laser and to avoid a penalty.

**Pre-Lab (week 2 – worth 5 marks)**
Submit the Python code you have written for your lab.

**Procedure:**
Feel free to follow whatever procedure you believe is appropriate. Create your own software to control your current source and photoreceiver to characterise the photonic devices. This Python code is worth 5 marks. The lasers are very sensitive, and instructions have been provided regarding proper handling of these lasers. Marks will be deducted if the laser is damaged and not returned in working order. There is some mechanical design required to ensure consistent coupling between the light emitters and the photodiode. Please comment on why your mechanical design is optimal.

**Measurements**
Fully characterise the red laser, and different colours of LEDs.
This requires the measurement of:

- The sense voltage of the current source – to extract current through the device.
- The voltage across the device (2 and 4 point preferably).
- The voltage from the photoreceiver – to extract the optical power.

WARNING: The laser and LED may may not be able to handle 80mA without being damaged. So, it is in your best interest to read the spec sheets first.

Data & Discussion:

- Superimpose the 2 wire, 4 wire (VI) and optical (LI) curves on the same graph with multiple y-axes and put this in your writeup. There should be one graph per device.
- Use the numerical analysis in your Python program, or your graphing program to provide the series resistance of each device (for both methods of testing).
- Comment ***extensively*** on the properties of the devices, especially relating to band structure / quantum mechanics. [worth minimum 2 points]

The lab should only take one week, but as it is near the end of term, two weeks are provided.

## Submission due: see Canvas