**Scientific Research Methods**

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| Level | 5 (Semester 1) |
| Duration | 4 weeks |
| Lectures | 10x40 minutes/week for 2 weeks |
| Practicals/tutorials | 5x2 hours/week for 3 weeks |

**Overview**

This course provides an introduction to experimental research for science and engineering. A key focus is on proper experimental design, supported by honest evaluation through the use of, usually, statistical methods. The course uses many examples of widely varying types as illustration of how empirical research should - and should not - be done in the sciences.

**Learning Outcomes**

* By the end of the course students will have acquired the following:
* Knowledge and understanding of the theory and practice of scientific and engineering research including: philosophical ideas underpinning different research approaches; quantitative and qualitative research methods; the research process; the social implications and wider context of research;
* An understanding of statistical hypothesis testing, an ability to use statistics to evaluate results, and a related ability to design good experiments for different types of hypotheses;
* An ability to review existing research, critique published literature, critically evaluate and assess evidence and the quality and validity of research;
* An ability to use appropriate, modern tools to perform analysis and present results;
* Transferable intellectual skills including critical thinking, constructing an argument, and writing skills.

**Syllabus**

* The Scientific Method
* Tools for reporting research, including LaTeX
* Literature and background research
* Experimental Design
* Statistical Hypothesis Testing
* Probability and Statistics Refresher
* Computational Tools for Statistics: Using the R Language
* Nonparametric Statistical Tests and Experimental Design
* Parametric Statistical Tests and Experimental Design
* Qualitative Methods
* Summary and Notes on Common Methodological Errors