

PHYS 801 – Physics Research Skills

The purpose of this unit is to provide skills that will be useful during higher research degree candidature and beyond. The first half of the unit addresses basic research skills. The second half is a module chosen from amongst Research Management, Astronomical Research, and Theoretical Physics Research. The course will be graded on a pass/fail basis. Each assessment task must be completed satisfactorily to pass the unit.

A. Physics research training module (Semester 1)

One 2 hour lecture per week.

- Week 2 (Stinson/Wardle): Library resources; databases; journals; Cornell arXiv preprint server; SCI and journal impact factors; Endnote.
- Week 3: Computing resources; CTS rules and guidelines; METS rules & guidelines; Drawing/CAD.
- Week 4 (Wardle): Introduction to LaTeX; LaTeX systems and editors; CTAN.
- Week 5 (Wardle): Grant and proposal writing.
- Week 6: Technical writing and speaking; preparation and submission of papers; the refereeing process; posters and oral presentations.
- Week 7: Maintaining lab books and note books; overview of IP and ethics issues and requirements.

Assessment tasks:

create an Endnote database containing papers relevant to a topic

brief literature review and project outline in LaTeX

critique MU PGRF applications; draft application to the ICS PGRF.

plan a visit to a laboratory or institute.

B1. Research Management

This module consists of the second half of ITEC 843:

- Week 7: Research Design & Ethics - design as a process and its application to empirical studies, including ethical aspects.
- Week 8: Managing Research - management aspects of successful R&D, infrastructure for supporting R&D.
- Week 9: Innovation & IP - the nature of technological change, creativity, product life-cycles, sources of innovation, IP, competitive positioning, entrepreneurship.
- Week 10: Technology Transfer - elements of technology transfer, criteria for success and failure, case histories.
- Week 11: Strategic Alignment - competitive assessment, leadership, strategy, culture, case histories.
- Week 12: Assessed Presentations - based on the research design topic handed out in class.

B2. Astronomy & Astrophysics Research Skills

This module can be tailored to suit the needs of the student. An example programme would be as follows: One 2 hour lecture/tutorial per week.

Week 7: Astronomical electronic resources; NASA Astrophysics Data System; astronomical databases; journals; and the astro-ph preprint server.

Week 8: Astronomical & Astrophysical software tools and resources; MIRIAD, IRAF, AIPS, CLOUDY etc.

Week 9: National and international astronomical facilities; writing observing proposals.

Weeks 10–12: Astronomical datasets and statistical techniques for astronomical data.

Assessment tasks to include: hypothetical observing proposal to use the ATNF compact array; multiwavelength/multidatabase data retrieval for selected astronomical objects; data analysis and statistics exercises.

B3. Theoretical Physics Research Skills

One 2 hour lecture per week.

The Mathematica or LaTeX sections of MATH 843, depending on students' background.