AS5001 - Advanced Data Analysis

Credits:	15.0	**Semester:**	1
Number of Lectures:	27	**Lecturer:**	Prof Keith Horne
Academic Year:	2017-18		

Overview
Astronomers and other physical scientists fit models to quantitative observational or experimental data in order to answer questions about the physical world. Data are always affected by measurement errors, leaving uncertainty in the answers to questions posed. Probability theory provides a precise language for discussing and expressing those uncertainties. Statistical data analysis provides practical tools for posing questions and teasing answers from the data. Analysis of real datasets is the best way to build expertise in quantitative data analysis.

Aims & Objectives
To develop an understanding of basic concepts and offer practical experience with the techniques of quantitative data analysis.

Learning Outcomes
By the end of the module, students should be comfortable with the concepts of probability theory and statistics, familiar with techniques for quantitative data analysis, and confident in their ability to tackle data analysis problems in physics & astronomy or wherever they may arise in their future work.

Synopsis
Beginning with fundamental concepts of probability theory and random variables, practical techniques are developed for using quantitative observational data to answer questions and test hypotheses about models of the physical world. The methods are illustrated by applications to the analysis of time series, imaging, spectroscopy, and tomography datasets. Students develop their computer programming skills, acquire a data analysis toolkit, and gain practical experience by analyzing real datasets. The module is assessed continuously on the basis of exercises and projects.

Pre-requisites
Familiarity with scientific programming language essential, for example through AS3013 or PH3080.

Anti-requisites
None

Assessment
Continuous Assessment = 100%

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.

This module has two homework sets and two projects involving a mix of analytic work and computer analysis of datasets provided.

Homework 1 issued at start of Week 1, due start of Week 4.
Homework 2 issued at start of Week 4 due end of Week 6.
Project 1 issued in Week 6 due at end of Week 9.
Project 2 issued in Week 6 due at end of Week 11.

This is a 15 credit module, so is expected to take 150 hours of study for the average student at this level. The module's work is finished by revision week, so students can expect to commit about 14 hours a week to the module in weeks 1 to 11, including the hours scheduled in lectures and for independent work on the assignments. Students are invited to use whatever programming tools or languages they deem to be most efficient for them in working on the assignments.

MPhys students are reminded that if they choose multiple "no-exam" modules then they will inevitably

have a higher workload per week during weeks 1 to 11 than if they chose modules where some of the 150 hours was spent in the revision and exam weeks.

Recommended Books
Please view University online record:
http://resourcelists.st-andrews.ac.uk/modules/as5001.html

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