OBSERVATIONS, DATA ANALYSIS, & STATISTICS: ASTR-5550

This document presents topical guidelines for instructors of one of the five APS core graduate courses. It is provided as a reference to support instructors in their syllabus preparation, and to assist the APS Examinations Committee in their review of those syllabi. Following each set of primary/recommended topics (in black), we list suggested optional topics (in) and example applications to APS research fields (in green) suitable for student projects, scientific coding, or homework exercises. It is anticipated that instructors focus at least two-thirds of class time on the primary course topics, with the remaining time spent on optional topics or other related topics of the instructorôs choosing. Instructors are encouraged to draw upon a range of examples from astrophysics, planetary science, and solar/space physics to illustrate the core material. The current version of these guidelines was adopted by the AY20-21 and AY21-22 Graduate Curriculum and Concerns Committees (GCCC). Future changes/updates will be made regularly; alternately, changes can be proposed to the GCCC.

Probability

Definitions of te

Noise and Signal Processing

Shot noise
Sky subtraction

Nyquist-Shannon sampling theorem
Filtering in the time or frequency domain

Application: simulating observed data with various noise sources
Application: Fourier applications & extensions: wavelet transforms; Lomb-Scargle

Detectors and Data Analysis

Practical CCD imaging & photometry (basic data reduction; error propagation)
Multiwavelength data gathering and analysis methods: e.g.,

Application: reduce & analyze real data for any of the above techniques

Spectroscopy

Basic principles of optical spectroscopy
Spectral resolution, bandwidth, noise sources

Application: fitting & analyzing absorption/emission line data