EE/METEO 477 – Fundamentals of Remote Sensing Systems

Designation: EE elective course for electrical engineering and meteorology majors.

University Bulletin Description: EE 477 (METEO 477). (3) The review of fundamental physical properties leads into discussions of various techniques, including imaging, spectroscopy, radiometry, and active sensing.
Prerequisite: EE 330.

Prerequisites by Topics: Introductory electromagnetics and/or radiative transfer or instructor's consent.

Textbook/Required Materials:
Physical Principles of Remote Sensing, 2nd Edition by W.G. Rees.
Class notes (as well as other course material) are available at the course website (ANGEL).
Several reference texts are held on reserve in the Engineering Library:
Remote Sensing of the Lower Atmosphere by Stephens,
Introduction to the Physics and Techniques of Remote Sensing by Elachi,
Remote Sensing: The Image Chain Approach by Schott,
Laser Remote Sensing by Measures,
Microwave Remote Sensing, vol. 1 & vol. 2 by Ulaby et al.,

Learning Outcomes:
This course provides a broad exposure to the engineering of remote sensing systems. Through lecture and out-of-class assignments, students are provided learning experiences that enable them to:

1. Analyze and design basic remote sensing systems.
2. Interact and work with students outside of their college.

Topics:
1) Remote Sensing Systems Framework
2) Electromagnetics and Radiative Transfer (Scattering Theory, etc.)
3) The Environment (Composition and Structure)
4) Passive Systems
    a. Optical-Wavelengths (Imaging, Spectroscopy)
    b. Radio-Frequency (Radiometery)
5) Active Systems
    a. Radio-Frequency (Radar)
    b. Optical Wavelengths (Lidar)
6) Additional Methods (e.g. Acoustic, THz systems, etc.)
7) Platforms, Error Analysis, etc.
8) Multi-Sensor Systems/Applications/Design

Class/laboratory schedule: Three 50-minute lectures per week.

Computer usage:
Several homework assignments require the use of a computer program such as MatLab, MathCad, etc. The choice of software and platform is left up to the student.

Laboratory Projects/Assignments:
None, though students receive several tours of existing remote sensing instrumentation laboratories at Penn State.

Contribution to Meeting the Requirements of Criterion 5. Curriculum:

This course contributes to both the engineering topics and design components.
This course provides a system level viewpoint of remote sensing. It is a prerequisite to additional technical electives, primarily specific graduate level courses in remote sensing.

Relationship to Program Outcomes:

O.1.1. Graduates will possess mathematics skills necessary for electrical engineering.
O.1.2. Graduates will have a theoretical and practical background in both physics and chemistry.
O.1.3. Graduates will have attained computer proficiency.
O.2.4. Graduates will understand fundamental electricity and magnetism concepts and be able to use them in applications.
O.3.1. Graduates will have in-depth technical knowledge in one or more areas of specialization.
O.3.2. Graduates will have practical understanding of the major electrical engineering concepts and demonstrate application of their theoretical knowledge of the concepts.
O.4.2. Graduates will develop an appreciation of continuing educational and professional development.
O.5.1. Graduates will have good teamwork skills.
O.5.2. Graduates will possess good oral and written communication skills.
O.6. Graduates will appreciate their role as engineers in society.

Prepared by: Timothy J. Kane **Date:** 3/15/08