EE 477 Fundamentals of Radar, Sonar, and Navigation Systems

**Designation:** Optional

**Catalog Description:**
Acoustics, sonar, ray theory, antennas for radar, radar cross section, radar systems, propagation, navigation systems, GPS

**Credits:** 3  
**Prerequisites:** EE371 Engr Electromagnetics  
**Class/Lab Schedule:** 3 lecture hours per week

**Topics Covered:**
This course covers the fundamental concepts of radar, sonar, and navigation systems. The topics covered are

- **Acoustics and Sonar:** Basic solution of plane waves, wave equation derivations, spherical & cylindrical waves, R & T coefficients, single Z termination, lumped element approximation, wall transmission loss, vibrating string, ray theory (20 hrs)
- **Radars:** Radar frequencies, antennas for radars, range resolution and bandwidth, Nyquist sampling, Doppler effect and resolution, radar cross section, fundamental aspects of electromagnetics, scattering, and diffraction in radar systems. (18 hrs)
- **Navigation systems:** GPS, propagation. (2 hrs)

**Text Book and Other Required Materials:**

**Course Objectives and Their Relationship to Program Objectives:**
The student learns the fundamentals of physical acoustics and sonar, basic radar principles, and modern navigation systems and general propagation phenomena. [Program Objective this course addresses: 1,2,3,4,5]

**Course Outcomes and Their Relationship to Program Outcomes:**
The following are the course outcomes and the subset of Program Outcomes (numbered 1-11 in square braces "[ ]") they address:

- Use of physical acoustics, electromagnetics, wireless communications, and mathematics to understand fundamentals of radar, sonar, and navigation systems. [1,2, 3,5,9]
- Develop the ability to understand and design basic sonar, radar, and navigation systems [1,2,3,5,8,9,10,11]
Contribution of Course to Meeting the Professional Component
Mathematics: 50%, Physics: 50%

Computer Usage:
Computer usage is minor. Computer language program (Matlab, C++, Fortran, etc.) is used to verify some concepts derived in class and in homework problems.

Design Credits and Features:
EE 474 has 0 design credits.

Instructor(s): Sungkyun Lim.

Person(s) Preparing Syllabus and Date: Sungkyun Lim, Jan. 3, 2008.