**EE 477 Fundamentals of Radar, Sonar, and Navigation Systems**

**Credits:** 3

**Categorization of credits:** engineering topic

**Instructors or course coordinator:** Zhengqing Yun

**Textbook and Other Required Materials**:

Text: Fundamentals of physical acoustics, by D. T. Blackstock, Wiley-Interscience, 2000.High-Resolution Radar, second edition, by D. R. Wehner, Artech House, 1995.

Supplements: Introduction to Radar Systems, third edition, by M. I. Skolnik, McGraw-Hill, 2001.

**Designation**: Elective

**Catalog Description:** EE 477 Fundamentals of Radar, Sonar, and Navigation Systems (3) Discussion of basic radar detection and position- and velocity-measurement principles. Applications to various types of radar and sonar systems. Modern navigation aids. Pre: 371 (or equivalent), and familiarity with waveguides or waveguide theory. DP

**Prerequisites:** EE371 (Engr Electromagnetics I)

**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)

**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 1-7 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, 6, 7]

• Develop the ability to understand and design basic sonar, radar, and navigation systems

[1, 2, 4, 6, 7]

**Contribution of Course to Meeting the Professional Component**

Engineering Topics: 100%

**Computer Usage:**

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.

**Person Preparing Syllabus and Date:** Zhengqing Yun, Sept. 29, 2014. Modified by A. Ohta, Jan. 20, 2021.