

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.