ECE4390 Course Syllabus

ECE4390

Introduction to Radar and Electromagnetic Sensing (3-0-0-3)

CMPE Degree
This course is Elective for the CMPE degree.

EE Degree
This course is Elective for the EE degree.

Lab Hours
0 supervised lab hours and 0 unsupervised lab hours

Course Coordinator
Cohen,Morris B

Prerequisites
ECE 3025

Corequisites
None

Catalog Description
Radar transmission, scattering, detection. Air traffic control, meteorological, others. Signal processing, doppler shifts, tracking, estimation, rain and clutter, atmospheric propagation, antennas. Remote sensing, LIDAR, SONAR.

Textbook(s)
Skolnik, *Introduction to Radar Systems* (3rd edition), McGraw Hill, 2002. ISBN 9780072881387 (required)

Course Outcomes
Upon successful completion of this course, students should be able to:

1. Distinguish between different types of radars for different applications
2. Analyze the building blocks to modern radars, including antennas, transmission schemes, atmospheric and ionospheric propagation, signal detection, estimation, tracking, noise and clutter reduction
3. Identify the tradeoffs that underly radar design and implementation
4. Analyze an existing radar system, synthesize the information and explain to an audience
5. Describe several application areas of radars for remote sensing

Student Outcomes
In the parentheses for each Student Outcome:
"P" for primary indicates the outcome is a major focus of the entire course.
“M” for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.
“LN” for “little to none” indicates that the course does not contribute significantly to this

outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (M) An ability to communicate effectively with a range of audiences
4. (LN) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (M) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (LN) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (M) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

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Introduction - Historical Perspective
Radar Equation
  Detection in noisy data
  Radar cross section
  Pulsed radars
  Probability Density Function
  Ranging
Detecting Moving Objects
  Doppler effect
  Delay lines
  Pulse Doppler radars
  Velocity and range estimation
  Tracking single and multiple objects
Clutter
  Ground and sea clutter
  Rain and weather clutter
  Bird and insect clutter
Atmospheric electromagnetic effects
  Maxwell?s equations, wave propagation and power
  Atmospheric reflection and refraction
  Ionospheric reflection
Radar antennas
  Conventional
  Phased array
Special types of radars
  Synthetic aperture radar
  Over-the-horizon radar
  SONAR
  LIDAR
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