



# Infrared Detectors and Systems

## ECE 6533

**Credit Hours:**

3.00 - 3.00

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**Course Levels:**

Graduate (5000-8000 level)

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**Course Components:**

Lecture

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**Course Description:**

This course covers the basics of infrared photodetectors and systems. It will include basic geometrical optics, radiometry, figures of merit and types of infrared detectors.

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**Prerequisites and Co-requisites:**

Prereq: 5530, or permission of instructor.

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**Course Goals / Objectives:**

- Be exposed to the fundamentals of an infrared detector including figures of merit
  - Be familiar with radiation transfer from an infrared source to a detector through an optical system and know the various radiometric quantities
  - Be familiar with the operation of thermal detectors, classical and advanced photon detectors
  - Be familiar with performance of single pixel and small format arrays for a variety of applications
  - Be able to communicate the concepts that you have learnt in a written and oral presentation.
  - Be exposed to working in a team and evaluate/assess your individual performance and the performance of your teammates
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**Course Topics:**

- Geometrical Optics (Imaging concepts, Aperture stops and pupils, Field of view and Image Quality)
  - Radiometry (radiometric quantities, blackbody radiation, emissivity, incremental limit equation, spectral/spatial/time dependent integration, special cases of radiation transfer)
  - Basics of Infrared Detection (Photon detection mechanisms, Thermal detection mechanism)
  - Noise in Infrared Detection (Photon noise, Johnson Noise, Shot noise, Generation Recombination Noise)
  - Figures of Merit for Infrared Detectors (responsivity, noise equivalent power, detectivity, photon-noise limited performance, Johnson noise limited performance)
  - Photovoltaic Detectors (PN diodes, PIN diodes, Silicon, Germanium, InSb, GaAs, Mercury Cadmium Telluride)
  - Photoconductive Detectors (Analysis of photoconductive gain, temporal response, intrinsic and extrinsic detectors)
  - Thermal detectors (theoretical performance of thermal detectors, responsivity and noise, bolometers, pyroelectric detectors)
  - Band-engineered detectors (Quantum well and Quantum Dot infrared photodetectors, Type II superlattice detectors, Unipolar barrier detectors)
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**Designation:**

Elective