Avionics and CNS Related Courses at Ohio University

The AEC is a research unit of the Ohio University School of Electrical Engineering and Computer Science (EECS). As such, the majority of the undergraduate and graduate students working with the AEC are majoring in Electrical Engineering. Students receive a thorough theoretical grounding through the numerous courses offered in navigation systems, including the following:

EE 4403/5403 – Antenna and Microwave Theory: Fundamental concepts and definitions for radiating systems including parameters, current distributions, matching, polarization and their effect on antenna performance. Transmission links, linear wire, loop, aperture, and array antennas discussed.

EE 5853/6863 – Electronic Navigation Systems I & II: Principles and theory of operation of electronic navigation systems with emphasis on avionics; aircraft instrumentation, VOR, DME, inertial navigation, Loran, ILS, MLS, GPS, air traffic control, surveillance radar, data busses, flight testing.

EE 601 – Electromagnetic Wave Propagation for Electronic Navigation Systems: Electromagnetic principles and propagation of radio waves over the earth surface and through the atmosphere. Topics include groundwaves, skywaves, troposphere and ionosphere effects, Total Electron Content, group and phase velocity, incident fields, reflection coefficients, Brewster angle, diffraction, scattering, Fresnel zone, and signal multipath.

EE 6023 – Radar Systems: This course covers the theory of operation of radar systems. Topics include the radar equation, radar cross-sections, radar altimeter, Air Traffic Control radar, Doppler radar, weather radar, synthetic aperture radar, Mode A/C/S.

EE 6033/6043 – Inertial Navigation Systems I & II: Principles of operation of inertial navigation systems. Topics include rigid body kinematics, observation equations, attitude update, earth rate and transport rate, position and velocity updates, sensor technologies, error characterization and modeling.

EE 6053 – Satellite-Based Navigation Systems: Theoretical development of spread-spectrum ranging and positioning with space-based transmitters. Particular emphasis on GPS. Orbital parameters (almanac and ephemeris), link budget, signal structure, receiver architecture, measurements and error sources. Absolute and relative positioning methodologies.

EE 6133 – High Accuracy Satellite Navigation Systems: Theoretical development of correction and measurement based differential satellite navigation technologies, with emphasis on advanced error mitigation techniques and error analysis. High accuracy code and carrier phase processing emphasized with presentation on carrier-phase ambiguity resolution techniques.

EE 6063 – Integrated Navigation Systems: Theoretical development of positioning and navigation with multiple sensors; optimal navigation solutions; the Kalman Filter as an integration tool; fault detection and isolation.

EE 6073 – Navigation Receiver Design: Theoretical development of receiver design with emphasis on spread spectrum ranging; low-noise amplifiers; radio frequency processing; down conversion and intermediate frequency processing; in-phase and quadrature components; analog-to-digital conversion; signal acquisition, tracking and measurement formation.

EE 6083 – Aviation Standards, Software Design and Certification: Overview of aviation standards including Federal Aviation Regulations, Technical Standard Orders, Advisory Circulars, RTCA documents and ARINC standards. Software design using military and civilian standards, IEEE software standards, software life cycle processes, program design language, documentation, testing, independent test verification, case studies.

EE 6900 – Special Topics in Electrical Engineering - GNSS Antennas: The fundamentals of antennas for GNSS antennas are covered including topic on radiation characteristics, beamwidth, bandwidth, impedance, matching losses and characterization. Various antenna types used in GNSSs are covered including linear, helix, microstrip patch, and array antennas. Antenna radome, ground plane, and siting effects are discussed, as well as, antenna design/simulation and measurement techniques.

EE 6900 – Special Topics in Electrical Engineering - Satellite Communications: This course covers the fundamental of satellite communications including topic on orbital mechanics, satellites subsystems, satellite antennas and their coverage regions (global, regional, spot beams), satellite link design, modulation, multiplexing, and multiple access techniques, error control coding-overview, propagation effects in satellite links, VSAT (Very Small Aperture Terminal) systems, Direct Broadcast Satellite (DBS) TV and radio system.