THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Advanced Topics in GPS

CIVILEN 8443

Credit Hours:
3.00 - 3.00

Course Levels:
Graduate (5000-8000 level)

Course Components:
Lecture
Lab

Course Description:
Advanced topics in GPS focused on science, engineering and navigation applications of GPS: Positioning algorithms; Remote sensing with GPS; GPS atmospheric studies; GPS integration with other navigation and imaging sensors (digital cameras, LIDAR).

Prerequisites and Co-requisites:
Prereq: 7442, 6461, or GeodSci 650, 651, or equivalent; or permission of instructor.

Course Goals / Objectives:
- Gain advanced exposure to the operational concepts of the Global Positioning System (GPS) and its importance to several areas of science and engineering
- Become familiar with the advanced theory of various methods of positioning with satellites and the GPS system augmentation, as well as new and emerging Global Navigation Satellite Systems (GNSS); GPS integration with other sensors
- Become familiar with the state-of-the-art research in the area of GPS applications to space science, meteorology, space weather motoring, and climate study; Advanced GPS/GNSS algorithms, GPS modernization
- Become familiar with basic use of wireless networks for indoor navigation and integration of wireless network with GNSS and other means of navigation
- Conduct independent research on selected topics; Reports are presented in class

Course Topics:

- Future of the GPS constellation; upcoming system modernization; Galileo and GLONASS vs. GPS; DGPS status and future.
- Advanced GPS algorithms for medium to long-range kinematic positioning; batch least squares and Kalman filter approaches; single base vs. multi-base station approach; virtual reference station (VRS) concept.
- Ionosphere retrieval from the permanently tracking networks and optimal modeling for RTK processing.
- Carrier phase ambiguity resolution concepts and methods, including on-the-fly (OTF) methods; single epoch vs. multiple epoch solution; ambiguity verification test.
- GPS as a tool in geophysics and geodynamics; observation equation including the global geodynamics parameters; estimation of tropospheric refraction, satellite and receiver clock estimation, earth rotation estimation.
- Methods of GPS orbit determination with special emphasis on the OSU-developed triple difference method; International GPS Service (IGS): activities, products, and services.
- Use of GPS occultation technique for atmospheric sounding; temperature, pressure, humidity profile retrieval; basics of the ionospheric profiling; review of the spase-based occultation missions; atmospheric profiling with ground based GPS networks.
- Pseudo-satellites and their use in navigation, precision landing and space navigation (GRACE); Principles of integrating GPS with GNSS and inertial navigation; integration of GPS/INS with modern imaging sensors (digital cameras, LIDAR.
- State-of-the art artificial intelligence methods used for GPS/GNSS augmentation for GNSS-challenged environments; personal and indoor navigation using Fuzzy Logic and Artificial Neural Networks, wireless networks and non-linear filtering techniques.

Designation:

Elective
Required