

**CN405 Fundamentals of GNSS I with emphasis on GPS**  
**September 21, 2009, 8:30 am-12:00 pm, CEU: 3.0**  
**GNSS Solutions® Tutorials prior to ION GNSS 2009, September 21-22, 2009**  
**Marriott Savannah Riverfront, Savannah, GA**

**Instructor:** Dr. Chris G. Bartone, P.E., Associate Professor, Ohio University

**Prerequisite:** Some knowledge of mathematics and computer science will be useful.

**Intended Audience:** Engineers, scientists, and managers interested in the area of GNSS using GPS, Galileo, Glonass, and/or other satellite navigation systems. The course provides a solid basis in the fundamentals of satellite navigation. The course is more advanced than a simple user's course, but not too detailed for the beginner to GNSS.

**Notes Provided:** Slides presented will be professionally spiral bound, with clear plastic cover, including color to add clarity where needed.

**Reference List:** A reference list will be provided as part of the note package for completeness and to allow the interested attendee to obtain additional information.

**Course Overview:** This course emphasizes the fundamentals of GNSS with emphasis on GPS. The core functions need to be performed in obtaining a user solution using GPS in an error free environment will be explained. The course concludes with an illustration of a user state calculation, and an introduction to an error budget in GPS.

**Course Content:** The main topics to be covered by this course are:

- GPS Segments: Control, Space, User.
- Coordinate frames and datum's used in the application of GNSS.
  - Introduction to Positioning & Satellite Navigation
  - Earth Centered Inertial (ECI)
  - Earth Centered Earth Fixed (ECEF)
  - Latitude, Longitude, Height (LLH)
  - Height Mean Sea Level (MSL)
  - Height: Geodetic, MSL, Geoid Undulation
  - World Geodetic System (WGS)-84,
  - International Terrestrial Reference Frame (ITRF)
  - Local Level Tangent (LLT)
  - Coordinate Conversions
- GPS signal structure formats for current and future signals.
  - Basic/Legacy GPS: C/A, P(Y) code formats
  - Modernized GPS, Galileo and Glonass (Overview)
- GPS Link Budget
- GPS Navigation Message Data Format Descriptions
- Calculation of the GPS space vehicle (SV) position using the broadcast Kepler parameters (ephemeris and almanac)
- GPS Time Considerations

- Calculation of user state (i.e., position and time)
- Associated performance parameters (i.e., dilution of precision terms)
- GPS error budget (overview)

**Course Outcomes:** At the completion of this course, the attendee should have the ability to understand the fundamentals of GNSS as applied to GPS and knowledge of the core functions that need to be performed to obtain a users solution in an error free environment. For additional knowledge for in error mitigation CN406 Fundamentals of GNSS II with emphasis in GPS is recommended.