ATLB-2180: GPS

Cuyahoga Community College

Viewing: ATLB-2180 : GPS

Board of Trustees:
2017-06-29

Academic Term:
Spring 2019

Subject Code
ATLB - AIT-Construct/Hazard Material

Course Number:
2180

Title:
GPS

Catalog Description:
Advanced course covering the basic operation of the GPS and its application to the construction industry. Included are field exercises and application of related math concepts used to locate property boundaries and longitudinal and latitudinal coordinates.

Credit Hour(s):
2

Lecture Hour(s):
2

Requisites

Prerequisite and Corequisite
Departmental approval: admission to Laborer's apprenticeship program.

Outcomes

Course Outcome(s):
Explain the function of the global positioning system (GPS) and describe how it is used in the construction industry.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Define the terms related to GPS operation and equipment.
2. List the applications of GPS as related to the construction industry.
3. Identify the components of the GPS and explain how they interact to establish relative grades.
4. Discuss the history of GPS and differentiate between military and civilian applications.
5. Discuss the different satellite systems and explain how they relate to each other.
6. Discuss the importance of geometric arrangement of the satellites with respect to the base station.

Course Outcome(s):
Summarize how GPS is used on construction sites for locating boundaries and jobsite features.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Explain the use of GPS files to locate proposed jobsite features.
2. Explain how property boundaries and respective right of ways are established using GPS.

3. List different pre and post jobsite features that are established using GPS.
4. Discuss how GPS is used in conjunction with earth moving equipment.

Course Outcome(s):

Discuss the limitations of the GPS with respect to equipment, communication and satellite positioning.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Explain the need to maintain the power source of the equipment.
2. Discuss the importance of good radio communication between the rover and the base.
3. Describe how high frequency signal transmission causes interference with equipment operation.
4. Explain the causes of autonomous positions and discuss the consequences to the operation.
5. Explain how positional accuracy can be increased using differential positioning.

Course Outcome(s):

Demonstrate the ability to operate GPS equipment and incorporate applied math concepts to establish site coordinates.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Set up the GPS base station over a reference point to establish accuracy between the rover and the base.
2. Power up the rover with the data collector to establish layout procedures.
3. Determine cuts and fills for jobsite using basic math concepts.
4. Operate the rover to verify building hubs and centerlines.
5. Select the respective screen on the data collector to perform required functions

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Methods of Evaluation:

1. Test
2. Quizzes
3. Classroom participation

Course Content Outline:

1. GPS and construction
    a. Terminology
        i. Global navigation satellite system
        ii. Satellite
        iii. Station
        iv. Base station
        v. Rover
        vi. Data collector
        vii. Positioning
        viii. Orbits
        ix. Receiver
        x. Coordinates
        xi. Real time kinematic
        xii. Ambiguity
        xiii. Multipath
        xiv. Dilution of precision
    b. Applications
        i. Site layout
        ii. Building coordinates
        iii. Topography
        iv. Centerline

v. Earth moving equipment
vi. Cuts and fills

c. Components
i. Tripod
ii. Base station
iii. Tribrach
iv. Optical plummet
v. Receiver
vi. Rover
vii. Radio transmitter
viii. Satellite

d. History
i. Military
1. Ivan setting
2. Missile defense
3. Orbiting satellites
4. Block I

ii. Civilian
1. Signal decode
2. Block I and II satellites

iii. Applications

e. Satellite systems
i. Galileo
ii. Glonas
iii. Compass
iv. GPS
v. Relationships
1. Atomic clocks
2. Radio transmission

f. Geometric arrangement
i. Satellite
ii. Base station
iii. Orbits
iv. Triangulation accuracies
v. Time

2. GPS and construction
a. Boundaries
i. Survey
ii. Coordinates
iii. Triangulation

b. Right of way

c. Pre and post jobsite
i. Topography
ii. Civilian drawings
iii. Storm water
iv. Parking areas

d. Earth moving equipment
i. Dozers
ii. Track hoe
iii. Graders
iv. Milling machines

e. GPS files
i. Computer
ii. Construction drawings
iii. Math

3. Limitations

a. Power source
    i. Rechargeable batteries
    ii. Radio loss
    iii. Environmental
b. Radio communication
    i. Distance
    ii. Frequency
    iii. Compatible equipment
    iv. Rover and base
c. Interference
    i. High frequency signals
    ii. Electromagnetic waves
    iii. Multipath
d. Autonomous positioning
    i. Radio
    ii. Base
    iii. Precision
    iv. Consequences
        1. Equipment failure
        2. Inaccurate readings
e. Positional accuracy
    i. Differential position
    ii. Radio
    iii. Distances

4. Operation and math
a. Equipment set up
    i. Tripod
    ii. Tribrach
    iii. Receiver
    iv. Data collector
    v. Control point
b. Rover and data collector
    i. Power source
    ii. Composite rod
    iii. Operations
c. Cuts and fills
d. Verification
    i. Building hubs
    ii. Coordinates
    iii. Centerlines
    iv. Offsets
    v. utility location
e. Data collector screen
    i. Menu
        1. Survey
        2. Configuration
        3. Equipment
        4. Files
        5. Tools
    ii. Math functions
        1. Coordinate math
        2. Calculations

Resources

LIUNA Training and Education Fund. *Global Positioning Systems".* current. LIUNA Training and Education Fund ; Pomfret Center, Connecticut 06259, 2007.

Wesley G. Crawford. *Construction Surveying and Layout.* second Edition. Creative Construction Publishing Co; West Lafayette, In. 47906, 1995.

Leica Geosystems. *"Surveying Made Easy".* current. Leica Geosystems; Norcross, GA. 30092, 1997.

Resources Other

"Construction Surveying"
http://surveying.wb.psu.edu/psu-surv/SURIs/construction.htm
Construction Surveying And Project Layout
http://cset.mnsu.edu/cm/students/aic-study-guide/level1kconstsurveying.pdf

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