

ATLB-2310: ADVANCED INSTRUMENTS

Cuyahoga Community College

Viewing: ATLB-2310 : Advanced Instruments

Board of Trustees:

2013-05-23

Academic Term:

Spring 2019

Subject Code

ATLB - AIT-Construct/Hazard Material

Course Number:

2310

Title:

Advanced Instruments

Catalog Description:

Instrumentation used for highway and building construction and layout. Includes calculations required for determining local coordinates, staking and road alignments, and the pinning of a building with offsets and open and closed transverses. Also included are procedures and techniques required for setting up and using total station equipment. Field applications and exercises.

Credit Hour(s):

2

Lecture Hour(s):

2

Requisites

Prerequisite and Corequisite

Departmental approval: admission to Construction Tending and Hazardous Material Abatement apprenticeship program.

Outcomes

Course Outcome(s):

I. Explain the procedures followed in establishing highway and building stakes, hub locations, applied math concepts and terminology used relative to highway and building construction layout.

Objective(s):

1. Review applied math concepts, including decimal conversions, triangulation and trigonometry with respect to construction layout.
2. Interpret the various markings on grade stakes with respect to elevations, offsets, and relative site cuts and fills.
3. Discuss the use of total station equipment for general layout and surveying purposes.
4. Identify the terms related to construction layout with respect to applied total station surveying operations.

Course Outcome(s):

II. Set up total station applications.

Objective(s):

1. Identify the different types of equipment.
2. List the components of a total station instrument system.
3. Discuss the environmental effects on total station equipment and its operation.
4. Demonstrate the ability to set up the equipment and use it to perform various applications.
5. Maintain and care for different types of surveying equipment.

Course Outcome(s):

III. Determine local coordinates for specified construction projects.

Objective(s):

1. Define the terms related to coordinate systems.
2. Explain the differences between latitude and longitude, state plane coordinates, and local coordinates
3. Establish a grid system with respect to given control points originating at the South East corner of the project.
4. Apply the principles of the Pythagorean Theorem to calculate diagonals.
5. Differentiate between azimuths and bearings.
6. Inverse between points to establish bearings, distances, and coordinates.

Course Outcome(s):

IV. Calculate stationing and offsets using triangulation principles and staking procedures.

Objective(s):

1. Explain stationing concepts with respect to geographic alignment.
2. Identify station points with respect to engineering format.
3. Discuss the use of various station equation concepts.
4. Differentiate between horizontal and vertical alignments.
5. Explain how offsets relate to centerline alignment.
6. Calculate the components of a simple curve using applied trigonometric functions.
7. Demonstrate the ability to position grade stakes with respect to elevations, centerlines, offsets and appurtenances.

Course Outcome(s):

V. Position a structure on a parcel of land.

Objective(s):

1. Identify building types by size and use.
2. Discuss different zoning requirements that affect set-backs and right of ways for utilities and other considerations.
3. Identify various layout controls, including primary, secondary, and third level control points that relate to building and utility placement.
4. Discuss how topographical surveys and civil site plans are used to establish existing and finish grades.
5. Demonstrate the ability to operate specialized surveying equipment, including total station to accurately position a building on a piece of property.
6. Establish building corners, offsets, and elevations for finish floor, above finish floor, grade and below grade.

Course Outcome(s):

VI. Apply open and closed traverses to construction layout and calculate coordinates for the specified control points.

Objective(s):

1. Identify the terms specific to traverses.
2. Calculate latitudes and departures with respect to right angles.
3. Apply mathematical concepts that are used for backchecking coordinates, angles, and distances.
4. Determine easting and northing coordinates.
5. Identify the coordinates of control points.
6. Explain how closing a construction layout affects primary and secondary controls.
7. Demonstrate the ability to use total station to locate points for building and highway jobsites.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Class participation

Course Content Outline:

1. Highway and construction layout
 - a. Terminology
 - i. Northings
 - ii. Eastings
 - iii. Control points
 - iv. Record keeping and field book
 1. Frontsight
 2. Backsight
 3. Height of instrument
 4. Interior angles
 - b. Math concepts
 - i. Decimal conversions
 - ii. Triangulation
 - iii. Applied trigonometry
 - c. Grade stakes
 - i. Positioning
 - ii. Markings
 1. Offsets
 2. Cuts
 3. Fills
 4. Stations
 5. Building corners
2. Total station
 - a. Surveying equipment
 - i. Auto level
 - ii. Digital level
 - iii. Lasers
 - iv. Global positioning systems (GPS)
 - b. Equipment
 - i. Tripod
 - ii. Prism
 - iii. Prism pole
 - iv. Data collector
 - c. Environmental effects
 - i. Rain and snow
 - ii. Cold weather
 - iii. Temperature acclimation
 - iv. Dust
 - d. Equipment set-up
 - i. Handling
 - ii. Tripod
 1. Adjustment
 2. Leveling
 - iii. Total station mounting
 - iv. Positioning
 - e. Lens cleaning
 - f. Equipment cleaning
3. Coordinate systems
 - a. Terms
 - i. Coordinate
 1. State plane
 2. World geodetic system
 - ii. Map projections
 - iii. Grid systems
 - iv. Bearings
 - v. Azimuths
 - b. Coordinates

- i. Latitude
 - ii. Longitude
 - iii. State plane coordinates
 - iv. Local
 - c. Grid systems
 - i. Control points
 - ii. Origin
 - iii. Grid matrix
 - d. Pythagorean Theorem
 - i. Right triangles
 - ii. Angles
 - iii. Distances
 - iv. Area
 - v. Diagonals
 - e. Azimuths
 - i. Degrees, minutes and seconds
 - ii. Circles
 - iii. Point of origin
 - f. Bearings
 - i. Defined direction
 - ii. Ninety degrees or less
 - iii. Direction based
 - g. Inverse
 - i. Bearings
 - ii. Distances
 - iii. Coordinates
- 4. Stations and offsets
 - a. Geographic alignment
 - i. South to North
 - ii. West to East
 - iii. Geographic boundaries
 - b. Engineering format
 - i. Identification
 - ii. One hundred foot increments
 - iii. Decimal feet
 - c. Stations equations
 - i. Alignment meeting points
 - ii. Road intersections
 - iii. Point identification
 - d. Alignments
 - i. Horizontal
 - ii. Vertical
 - iii. Curves
 - iv. Tangents
 - e. Offsets
 - i. Centerline alignment
 - ii. Perpendicular reference
 - f. Catch basins, headwalls and manholes
 - g. Curve calculation
 - i. Trigonometry
 - ii. Horizontal
 - iii. Vertical
 - iv. Offsets
 - h. Application
 - i. Stake positionng
 - ii. Equipment set up and use
 - iii. Cuts and fills
 - iv. Centerlines

- v. Record keeping
- vi. Equipment maintenance
- 5. Building layout
 - a. Buildings and structures
 - i. Size
 - ii. Use
 - b. Zoning
 - i. Set backs
 - ii. Right of ways
 - iii. Utility placement
 - c. Layout controls
 - i. Primary
 - ii. Secondary
 - iii. Third level controls
 - d. Topographic maps and civil site drawings
 - i. Contours
 - 1. Existing
 - 2. Finish
 - ii. Physical features
 - 1. Existing and proposed utilities
 - 2. Natural
 - 3. Elevation data
 - e. Specialized equipment
 - i. Auto levels
 - ii. Lasers
 - iii. Digital
 - iv. Total station
 - f. Corners, offsets and elevations
- 6. Traverses
 - a. Terminology
 - i. Northings
 - ii. Eastings
 - iii. Open and Closed
 - b. Latitude and departures
 - i. Calculations
 - 1. Applied trigonometry
 - 2. Corrections
 - ii. Right angles
 - c. Back checking
 - i. Coordinates
 - ii. Angles
 - iii. Distances
 - iv. Applied math
 - d. Closing box
 - i. Calculations
 - ii. Northings
 - iii. Eastings
 - e. Control points
 - i. Identification
 - ii. Accuracy
 - iii. Coordinate elevations
 - iv. Horizontal
 - v. Vertical
 - f. Layout closings
 - g. Application
 - i. Equipment set up
 - ii. Field notes
 - iii. Record keeping

- iv. Control points
- v. Calculations

Resources

Wesley G. Crawford. *Construction Surveying and Layout*. 2nd 3d. West Lafayette, IN: Creative Construction Publishing Co., 1995.

Nick Capachi. *Excavation Grading*. 4th ed. Chicago, IL: Craftsman Book Co, 1990.

LIUNA Training and Education Fund. *Roadway Construction*. Pomfret Center, CT: LIUNA Training and Education Fund, 2007.

LIUNA Training and Education Fund. *Construction Referencing Systems*. Pomfret Center, CT: LIUNA Training and Education Fund, 2007.

Resources Other

A. Integrated Publishing, *Engine Mechanics*. Port Richey, FL: Integrated Publishing, 2007. http://www.tpub.com/content/engine/14081/css/14081_448.htm

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