Course Number and Title: CET 144 Surveying Principles

Campus Location:
Georgetown, Dover, Stanton

Effective Date:
2018-52

Prerequisite:
CET 125 or (GIS 101 and GIS 110)), MAT 180, ENG 101,
SSC 100 or concurrent

Co-Requisites:
none

Course Credits and Hours:
4.00 credits
3.00 lecture hours/week
3.00 lab hours/week

Course Description:
This course examines theory and practice of plane surveying, including the use of tapes, levels, transits, and theodolites. Problems in triangulation, traverses, mapping, computation of areas, proper field procedures, and field book entries are covered.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
Civil engineers scale rule, calculator, surveying field book, and jump drive

Schedule Type:
Classroom Course

Disclaimer:
None

Core Course Performance Objectives (CCPOs):

1. Distinguish between the different types of surveying, and use this comparison to determine how surveying field data is used to produce a civil drawing. (CCC 1, 2, 4, 6; PGC: CET 1; SET 1, 5; ENV 1; CTO 1)
2. Identify common practices of every surveying project, including field notes, safety, and care of equipment. (CCC 1, 2, 4, 6; PGC: CET 1; SET 1, 5; ENV 1; CTO 1)
3. Apply the pacing method through field procedures, field book entry, and evaluations. (CCC 1, 2, 3, 5, 6; PGC: CET 1, 2, 4, 5; SET 1, 2, 4, 5, 6; ENV 1, 3, 4; CTO 1, 2, 3, 4)
4. Demonstrate the use of surveying tapes through field procedures, field book entries, and evaluations. (CCC 1, 2, 3, 5, 6; PGC: CET 1, 2, 4, 5; SET 1, 2, 3, 4, 5, 6; ENV 1, 3, 4; CTO 1, 2, 3, 4)
5. Employ vertical leveling, including running a level loop in the field and calculating elevations in a field book. (CCC 1, 2, 3, 5, 6; PGC CET 1, 4, 5; SET 1, 2, 3, 4, 5, 6; ENV 1, 2, 3, 4; CTO 1, 2, 3, 4)
6. Use elevations through field procedures and/or in class projects. (CCC 1, 2, 3, 5, 6; PGC: CET 1, 2, 4, 5; SET 1, 2, 3, 4, 5, 6; ENV 1, 3, 4; CTO 1, 2, 3, 4)
7. Set up and demonstrate competent field use of a total station theodolite. (CCC 2, 3, 5, 6; PGC CET 1, 2, 4, 5; SET 1, 2, 3, 4, 5, 6; ENV 1, 3, 4; CTO 1, 2, 3, 4)
8. Integrate turning vertical and horizontal angles in the field, and use these angles to perform classroom calculations and/or drawings. (CCC 1, 2, 3, 5, 6; PGC: CET 1, 2, 4, 5; SET 1, 2, 3, 4, 5, 6; ENV 1, 3, 4; CTO 1, 2, 3, 4)
9. Perform calculations common for a field stakeout using both coordinate measurements and radial stakeout measurements. (CCC 2, 3, 5, 6; PGC: CET 1, 2, 4, 5; SET 1, 2, 3, 4, 5, 6; ENV 1, 2, 3, 4; CTO 1, 2, 3, 4)
10. Describe the fundamentals of a boundary survey. (CCC 1, 2, 4, 6; PGC: CET 1; SET 1, 5; ENV 1; CTO 1)
11. Use a Global Positioning System (GPS). (CCC 2, 5; PGC: CET 1, 2, 4, 5; SET 1, 2, 3, 4, 5, 6; ENV 1, 2, 3, 4; CTO 1, 2, 3, 4)
12. Calculate the area of a traverse. (CCC 2, 5; PGC: CET 1, 2, 4, 5; SET 1, 2, 3, 4, 5, 6; ENV 1, 3, 4; CTO 1, 2, 3, 4,)
13. Demonstrate professional and ethical conduct as expected in industry. (CCC 1, 2, 3, 4, 5, 6; PGC: CET 1, 4, 5; SET 1, 3, 4, 6; ENV 3; CTO 1, 2, 4)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Distinguish between the different types of surveying, and use this comparison to determine how surveying field data is used to produce a civil drawing.
    1. Define surveying as a profession.
    2. Describe the role of surveyors in the civil/environmental engineering and construction industries.
    3. Explain the historical development of surveying and how surveying has evolved as a profession.
    4. Identify the different types of surveys and the maps created by them.
    5. Identify the units of measurements and conversion factors commonly employed in surveying.
    6. Describe land measurement techniques used in surveying.
    7. Identify and describe different types of land traverses and how they are used to produce a civil drawing.
2. Identify common practices of every surveying project, including field notes, safety, and care of equipment.
    1. Identify the general rules and requirements of all field notes.
    2. Describe standard surveying safety practices.
    3. Identify the different equipment used in surveying.
    4. Explain the purpose, parts, transport and care of common surveying tools and instruments.
3. Apply the pacing method through field procedures, field book entry, and evaluations.
    1. Perform a field pacing exercise.
    2. Enter pacing data in a standard surveyor's field book using proper entry procedures.
    3. Calculate the average length of pace.
4. Demonstrate the use of surveying tapes through field procedures, field book entries, and evaluations.
    1. Read and correctly use a surveyor's field tape graduated in feet, tenths, and hundredths.
    2. Record tape lengths in a surveyor's field book using the proper data entry format.
    3. Correct tape length measurements.
5. Employ vertical leveling, including running a level loop in the field and calculating elevations in a field book.
    1. Set up a leveling instrument in the field.
    2. Read and record rod readings using a Philadelphia rod.
    3. Calculate elevations of unknown field points.
    4. Check surveying measurements and calculations by converting a beginning elevation to an original benchmark.
6. Use elevations through field procedures and/or in class projects.
    1. Identify the vertical and horizontal datum for a known benchmark.
    2. Establish a new benchmark based on a known benchmark.
    3. Determine the elevations of a grid pattern for a contour exercise using a known benchmark.
    4. Interpolate contours from survey data.
7. Set up and demonstrate competent field use of a total station theodolite.
    1. Accurately set up a theodolite over an established point.
    2. Correctly level the instrument.
    3. Turn on the instrument, and demonstrate correct use of the basic functions, including distance measurement, horizontal angle measurement, and vertical angle measurement.
    4. Correct electronic distance measurements for specified errors and estimated errors.
8. Integrate turning vertical and horizontal angles in the field, and use these angles to perform classroom calculations and/or drawings.
    1. Zero set the instrument after back-siting an initial reference point.
    2. Turn the horizontal angle, and record it in a surveyor's field book using the proper method of recording data.
    3. Compute a vertical angle, and record it in a surveyor's field book using the proper method of recording the field data.
    4. Compute the horizontal angles related to a closed traverse, and check the results using standard calculation methods.
    5. Calculate the azimuth from survey data and information, including converting from bearings.
    6. Compute the vertical angles related to the elevation of a structure, and use these angles to determine the height of the structure.
    7. Compute and adjust a traverse to create geometric closure, including balancing angles, determining latitudes and departures, calculating linear misclosure, balancing latitudes and departures, and determining bearings and distances.
    8. Determine the accuracy and precision of a traverse and survey.
    9. Draw a plot plan to the appropriate scale per industry standards to represent a closed traverse using distances and horizontal angles from given northing and easting information.
9. Perform calculations common for a field stakeout using both coordinate measurements and radial stakeout measurements.
    1. Introduce field stakeout procedures.
    2. Calculate the coordinates of improvements on a site plan.
    3. Convert coordinates to distances and angles from a base line.
    4. Perform a field stakeout.
10. Describe the fundamentals of a boundary survey.
    1. Define terms related to legal descriptions.
    2. Describe horizontal datums, and explain why they vary from deed to deed.
    3. Describe and compute the difference between magnetic north and true north.
    4. Explain the different methods of defining a legal description.
11. Use a Global Positioning System (GPS).
    1. Sketch the main components of a GPS system, and define how a system operates.
    2. Participate in a class GPS demonstration.
12. Calculate the area of a traverse.

1. Using field data, calculate the area of a closed traverse using simple geometry.
2. Using field data, calculate the area of a closed traverse using the double meridian distance method (DMD).
3. Using field data, calculate the area of a closed traverse using coordinates.
4. Using field data, calculate the area of a closed traverse using simple geometry.
5. Convert area calculations in to units of acres.

13. Demonstrate professional and ethical conduct as expected in industry.
    1. Identify the need for self-discipline and time management in technical industries.
    2. Communicate and function effectively as a member of a team.

Evaluation Criteria/Policies:
Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	**–**	**100**	**=**	**A**
83	**–**	**91**	**=**	**B**
75	**–**	**82**	**=**	**C**
0	**–**	**74**	**=**	**F**

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Final Course Grade:
Calculated using the following weighted average

Evaluation Measure	Percentage of final grade
Formative: Assignments	5%
Formative: Surveying Lab – Pacing, Taping, Leveling, Topographic Grid, Closing the Horizon, Traverse, Construction Survey, GPS Survey (weighted equally)	40%
Summative: Traverse Closure Calculations	5%
Summative: Traverse Plot Plan	5%
Summative: Topographic Plan	5%
Summative: Tests (4) (weighted equally)	32%
Summative: Field Test	8%
Final Course Grade	100%

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):
CETAASCET:

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering activities, including but not limited to site development, hydraulics and hydrology, grading, and structural systems.
2. Conduct standardized field and laboratory testing on civil engineering project materials.
3. Select appropriate materials and estimate material quantities for technical projects.
4. Use graphic techniques and productivity software to produce engineering documents.
5. Demonstrate a commitment to quality, timeliness, professional development, and continuous improvement.

CETAASSET:

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities, including but not limited to site development, hydraulics and hydrology, grading, and structural systems.
2. Conduct standardized field and laboratory testing on civil engineering project materials.
3. Select appropriate materials and estimate material quantities for technical projects.
4. Use graphic techniques and productivity software to produce engineering documents.
5. Integrate appropriate surveying methods for land measurement and/or construction layout and the acquisition of spatial data in accordance with the laws and regulations pertaining to Professional Land Surveying.
6. Demonstrate a commitment to quality, timeliness, professional development, and continuous improvement.

ENVAASEET:

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering activities, including but not limited to site development, hydraulics and hydrology, grading, water and wastewater treatment, pollution prevention and treatment, and sustainable design.
2. Conduct standardized field and laboratory testing.
3. Demonstrate a commitment to quality, timeliness, professional development, and continuous improvement.
4. Use graphic techniques and productivity software to produce technical documents.
5. Explain the major aspects of the normal ecology of the planet and risks associated with polluting the environment.
6. Apply current federal, state and local environmental and safety regulations and industry best management practices.

CETAASCTO:

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering activities, including but not limited to site development, hydraulics and hydrology, grading, and structural systems.
2. Use graphic techniques and productivity software to produce engineering documents.
3. Apply fundamentals of science and mathematics to solve engineering problems.
4. Demonstrate a commitment to quality, timeliness, professional development, and continuous improvement.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.