BI 0008 - CIVIL APPLICATIONS OF COMPUTER-AIDED DESIGN

Catalog Description

Formerly known as DES 10
Prerequisite: Completion of ADVM 2 or BI 10 with grade of "C" or better or equivalent as determined by instructor
Hours: 90 (36 lecture; 54 laboratory which may be scheduled TBA)
Description: Development of drafting skills used in the areas of industrial and civil engineering support. Emphasis on land division, determination of location and direction, development of plots based upon legal description and the fundamentals of utilizing surveying data as applied to preliminary and final maps. Designed for students who have attained an intermediate knowledge of the processes and practices of engineering design/drafting support. Introduction to AutoCAD Civil 3D software. (CSU)

Course Student Learning Outcomes

- CSLO #1: Apply appropriate, current and relevant industry standards in preparing technical documentation for the appropriate discipline of their study.
- CSLO #2: Construct profile drawings using contour maps, profile measurement field notes and engineering sketches.
- CSLO #3: Demonstrate computer aided drafting practices that conform to business and industry CAD standards.
- CSLO #4: Design complete working drawings in discipline of study for use in manufacturing/building application.

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

90

Outside of Class Hours

72

Total Student Learning Hours

162

Course Objectives

This course requires 36 hours lecture and 54 hours laboratory. In some class sections, the 54 hours of laboratory may be scheduled "to be arranged" or "TBA." The TBA hours and objectives are expected of all students enrolled in the course.
Lecture Objectives:
I. Introduction to Civil Drafting Technology
1. Define civil drafting and civil engineering
2. Define terms related to maps and civil drafting
3. Define the difference between general and specific notes
4. Define scales used in mapping
II. Mapping Symbols
1. Identify types of symbols used with maps
2. Identify special techniques used to identify terrain features
III. Measuring Distance and Elevation
1. Describe methods of measuring distances
2. Discuss instruments used for the measurement of distance and elevation
3. Describe methods used for recording field measurements
IV. Surveying Fundamentals
1. Describe different types of surveys and the maps created by each
2. Identify the variety of surveying instruments
3. Describe the different types of land traverses
4. Compare and contrast the difference between an open and closed traverse
5. Define the numerical components of an angular measurement
6. Calculate bearings of property lines when given azimuths
7. Describe the global positioning system (GPS)
V. Location and Direction
1. Determine the azimuths of given lines
2. Calculate the distance on the earth's surface between given latitude and longitude points
3. Calculate the azimuth from given information
4. Establish the bearing, distance, cosine, sine, latitude, and departure from a given traverse
5. Determine the length and bearing of property lines from given northing and easting information and then draw the traverse
VI. Legal Descriptions and Plot Plans
1. Define terms related to legal descriptions and plot plans
2. Sketch plot plans that display specific characteristics
3. Write a legal description from a given plot plan
VII. Contour Lines
1. Describe topographical features using contour line characteristics
2. Identify different types of contour lines
3. Describe methods and equipment used for enlarging map
VIII. Profiles
1. Define profile drawings and their relationship to contour maps
2. Discuss intersection object
3. Discuss hatching cut and fill areas of a profile
4. Discuss profile labels
IX. Highway Layout
1. Discuss highway layout using the point curve and point of intersection methods
2. Calculate tangent distances for a vertical curve
X. Earthworks
1. Define and use angle of repose in a cut-and-fill drawing
2. Calculate quantities of earth removed from borrowed pits
3. Calculate earthwork volumes of cross sections using the average end method
XI. AutoCAD Civil 3D General Features
1. Identify and discuss user interface, Properties, Ribbon and Grid
2. Discuss data shortcuts
3. Identify navigation bar
4. Discuss report features and label features
XII. Survey / Points
1. Discuss list available points and Point group display border
2. Identify and discuss Import Survey Data Wizard
3. Discuss linework definition files
4. Discuss importing from ASCII files and Importing points from other drawings
XIII. Surface Features
1. Discuss handling of large or complex surfaces
2. Discuss importing and working with point could data

3. Discuss merge and split surfaces
4. Discuss using a datum on a bounded volume
5. Discuss clip boundary options
6. Discuss contour and masking options for contour labels
XIV. Alignments
1. Discuss creating alignments from objects
2. Discuss automatic curve widening
3. Discuss masking, dynamic offset and dynamic widening options for alignments
XV. Corridors & Sections
1. Identify visibility and drive commands
2. Discuss super elevations
3. Discuss selecting, isolating, and editing a region
4. Discuss zooming and navigation
XVI. Sections
1. Identify and discuss section sheets
2. Demonstrate volume calculation methods
XVII. Labels
1. Discuss formatting
2. Discuss geodetic labeling
Laboratory Objectives:
I. Introduction to Civil Drafting Technology
1. Calculate and utilize scales used in mapping
II. Mapping Symbols
1. Correctly utilize symbols used with maps
2. Demonstrate special techniques used to identify terrain features
3. Develop mapping symbols using computer-aided design software
III. Measuring Distance and Elevation
1. Utilize methods of measuring distances
2. Utilize instruments used for the measurement of distance and elevation
3. Demonstrate methods used for recording field measurements
IV. Surveying Fundamentals
1. Develop different types of surveys and the maps created by each
2. Utilize the variety of surveying instruments
3. Develop both an open and closed traverse
4. Calculate bearings of property lines when given azimuths
V. Location and Direction
1. Calculate the distance on the earth surface from given latitude and longitude points
2. Calculate the azimuth from given information
3. Establish the bearing, distance, cosine, sine, latitude, and departure from a given traverse
4. Draw a traverse from given information
5. Determine the length and bearing of property lines from given northing and easting information and then draw the traverse
6. Draw an approximate magnetic declination line from given data
VI. Legal Descriptions and Plot Plans
1. Sketch plot plans that display specific characteristics
2. Draw complete plot plans from given engineering sketches
3. Draw plot plans from written information
4. Convert plat map drawings to formal drawings
VII. Contour Lines
1. Develop topographical features using contour line characteristics
2. Utilize different types of contour lines
3. Create contour map field notes and use the interpolation method
VIII. Profiles
1. Construct profile drawings using contour maps
2. Construct profile drawings using profile measurement field notes
3. Construct plan and profile drawings using field notes and engineering sketches
IX. Highway Layout
1. Create a highway layout drawing using the point curve and point of intersection methods
2. Construct a vertical curve profile drawing
3. Calculate tangent distances for a vertical curve
X. Earthworks
1. Create an accurate cut-and-fill drawing of a proposed highway
2. Construct cross section drawings using cross section survey data
3. Construct an accurate cut-and-fill drawing of a proposed building site
4. Calculate quantities of earth removed from borrowed pits
XI. AutoCAD Civil 3D General Features
1. Utilize interface, Properties, Ribbon and Grid
2. Demonstrate data shortcuts
3. Utilize navigation bar
4. Utilize report features and label features
XII. Survey / Points
1. Utilize list available points and Point group display border
2. Utilize Import Survey Data Wizard
3. Utilize linework definition files
4. Demonstrate importing from ASCII files and Importing points from other drawings
XIII. Surface Features
1. Demonstrate work with large or complex surfaces
2. Import and work with point could data
3. Demonstrate merge and split surfaces
4. Use a datum on a bounded volume
5. Utilize clip boundary options
6. Utilize contour and masking options for contour labels
XIV. Alignments
1. Create alignments from objects
2. Utilize automatic curve widening
3. Utilize masking, dynamic offset and dynamic widening options for alignments
4. Demonstrate intersection object
5. Demonstrate hatching cut and fill areas of a profile
6. Develop profile labels
XV. Corridors & Sections
1. Utilize visibility and drive commands
2. Develop super elevations
3. Select, isolate, and edit a region
4. Demonstrate zooming and navigation
XVI. Sections
1. Develop section sheets
2. Demonstrate volume calculation methods
XVII. Labels
1. Demonstrate formatting
2. Demonstrate geodetic labeling

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- CSU Transferable

Methods of Evaluation

- Objective Examinations
  - Example: Q: Calculate the representative fraction or scale ratio for a map at 2"= 1 mile.

- Projects
  - Example: Students develop an industry quality portfolio that includes complete working drawings for CIVIL applications. Instructor evaluates accuracy to current, accepted industry standards for working drawings.
- Skill Demonstrations
  - Example: From survey field data develop a property plot plan complete with distances and bearings, bench mark data, appropriate field and survey information and complete legal plot description. Instructor evaluates the student performance of learned objectives, accuracy to current, accepted industry standards for working drawings and the efficient use of a CAD system.

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. The instructor will guide the student through synthesizing and applying the methods to formulate correct profile drawing which students will produce with complete documentation. (Laboratory Objective 8-2)

Lecture:

1. Instructor will present to the students, during a weekly lecture/presentation/discussion, advanced engineering design methodology. Students will discuss the methodology and strategize a plan to develop the appropriate profile drawings. (Lecture Objective 8-1)

Distance Learning

1. Students in online classes participate, individually and in groups, in discussion boards and respond to weekly assignments via the Learning Management System. The instructor will provide documented material (including videos) explaining or exploring the course content and provide individual feedback on all assignments. The instructor will lecture on measuring distance and evaluation. Students will then utilize instruments used for the measurement of distance and elevation in a specific area. (Laboratory Objective 3-2)

Typical Out of Class Assignments Reading Assignments

Students read chapters in the textbook on profiles and are expected to participate in the lecture/discussions based upon the reading. Construct a drawing, based upon course readings, demonstrating the weekly-learning objectives. These weekly drawings are either freehand sketches and/or computer-aided design (CAD) generated. The drawings are evaluated for compliance with American National Standards Institute(ANSI)standards. Critical thinking and problem solving are part of these assignments.

Writing, Problem Solving or Performance

1. Compare and contrast the difference between an open and closed traverse. 2. Problem solve the construction of 3D solid models and the relationship of geometry for feature definition.

Other (Term projects, research papers, portfolios, etc.)

1. Develop a portfolio that contains samples of semester assignments to show potential employers the engineering design support concepts studied. 2. Participate as a member of a design support team for the completion of a semester design project.

Required Materials

- Civil Drafting Technology
  - Author: Madsen
  - Publisher: Pearson Prentice Hall
  - Publication Date: 2017
  - Text Edition: 8th
  - Classic Textbook?: No
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.