



## Course Outline

2026-2027 Catalog

### ENGR 3 - Plane Surveying I

#### Catalog Description

**Transfer Status:** CSU/UC

**Prerequisite:** MATH 20, MATH 28, MATH 28s or high school trigonometry

**Unit(s):** 3.00

**Lecture:** 34.00 Contact hours/68.00 Out of class hours/102.00 Total hours/2.00 Unit(s)

**Lab:** 51.00 Contact hours/0.00 Out of class hours/51.00 Total hours/1.00 Unit(s)

**Total:** 85.00 Contact hours/68.00 Out of class hours/153.00 Total hours/3.00 Unit(s)

**Course Description:** The course applies theory and principles of plane surveying: office computations and design; operation of surveying field equipment; and production of engineering plans/maps. Topics include distances, angles, and directions; differential leveling; traversing; property/boundary surveys; topographic surveys/mapping; volume/earthwork; horizontal and vertical curves; land description techniques; and Global Positioning Systems (GPS). Extensive field work using tapes, levels, transits, theodolites, total stations, and GPS. (C-ID ENGR 180).

#### Objectives

Upon successful completion of this course, the student should be able to:

1. Operate survey equipment: tape, level, transit, theodolite, compass, total station, GPS.
2. Reduce field notes using various mathematical techniques to generate meaningful records describing horizontal and vertical control of landforms.
3. Perform office computations and design for differential leveling; traversing; area calculations; property/boundary surveys; topographic surveys/mapping; volume/earthwork; horizontal and vertical curves; and error analysis.
4. Plot plans and maps from field work data using manual and computer-aided drafting.
5. Work effectively in groups during field surveying and engineering design project which involve problem solving, report writing, and oral presentations.

#### Course Content

##### Topic Titles / Suggested Time Topic

##### Lecture

| <u>Topics</u>                                                                                | <u>Lec Hrs</u> |
|----------------------------------------------------------------------------------------------|----------------|
| Distance Measurements, Stadia Theory                                                         | 2.00           |
| Issues in Professional Practice; Professional Engineer (PE) and Land Surveyor (LS) Licensing | 2.00           |
| Property/Boundary Surveys; Metes and Bounds Descriptions                                     | 2.00           |
| Coordinate Geometry                                                                          | 2.00           |
| Differential Leveling                                                                        | 4.00           |
| Topographic Surveys and Mapping                                                              | 2.00           |
| Error Analysis                                                                               | 2.00           |
| Manual and Computer-Aided Drafting of Plans                                                  | 2.00           |
| Field Book, Equipment: Tapes; Levels; Transits; Theodolites; Total Stations, GPS             | 1.00           |
| Introduction to Geographic Information System (GIS)                                          | 1.00           |
| Construction Applications                                                                    | 1.00           |
| Angles and Directions; Compass                                                               | 2.00           |
| Traversing: Coordinates, Latitude/Departure, Land Area Calculation                           | 4.00           |
| Volume/Earthwork                                                                             | 2.00           |
| Horizontal and Vertical Curves                                                               | 2.00           |
| Introduction to Photogrammetry Theory/Viewing Aerial Photos                                  | 1.00           |
| Introduction to GPS                                                                          | 2.00           |
| <b>Total Hours:</b>                                                                          | <b>34.00</b>   |

##### Lab

| <u>Topics</u>                                                        | <u>Lab Hrs</u> |
|----------------------------------------------------------------------|----------------|
| Equipment: Tapes; Levels; Transits; Theodolites; Total Stations, GPS | 3.00           |
| Monument Referencing and Field Book                                  | 3.00           |
| Distance Measurements                                                | 3.00           |

| <b>Topics</b>                                              | <b>Lab Hrs</b> |
|------------------------------------------------------------|----------------|
| Differential Leveling                                      | 3.00           |
| Profile Survey                                             | 3.00           |
| Angles and Directions                                      | 3.00           |
| Radial Survey                                              | 3.00           |
| Closed Traverse                                            | 3.00           |
| Closed Traverse Computation                                | 3.00           |
| Site Maps and Property Boundary                            | 3.00           |
| Site Maps and Property Boundary: Special Topic             | 3.00           |
| Topographic Survey                                         | 3.00           |
| Topographic Modeling and Manual Drafting                   | 3.00           |
| Topographic Map Project: Planning and Field Measurement    | 3.00           |
| GPS                                                        | 3.00           |
| Civil 3D Computer-Aided Design (CAD) and Horizontal Curves | 3.00           |
| Error Analysis                                             | 3.00           |

**Total Hours: 51.00**

### Methods of Instruction

- A. Collaborative Group Work
- B. Homework: Students are required to complete two hours of outside-of-class homework for each hour of lecture
- C. Instructor Demonstrations
- D. Lecture
- E. Multimedia Presentations
- F. Problem-Solving Sessions

### Methods of Evaluation

- A. Exams/Tests
- B. Projects
- C. Homework
- D. Lab Projects
- E. Final Examination

### Examples of Assignments

#### Reading Assignments

1. Read the section of your text on differential leveling and be prepared to discuss the theory of leveling, its benefits and limitations.
2. Read the section of your text on error analysis and extra study materials provided by the instructor and be prepared to discuss the theory of errors in observations and the error propagation.

#### Writing Assignments

1. Using your surveying fieldbook summarize all measurements taken in the field and calculate all closures in latitude and departure.
2. The final entry in your surveying fieldbook will be a complete traverse of the quad, amphitheater, and tennis courts near the Butte College Quad. Be sure to include all bearings and distances, closures, and areas.

#### Out-of-Class Assignments

1. Complete a set of differential leveling field notes and perform all the appropriate arithmetical checks.
2. Calculate northing and easting of assigned surveying points by hand and by use of a spreadsheet and calculate the area of an assigned closed traverse. Perform the appropriate arithmetic checks.

### Recommended Materials of Instruction

Kavanagh, B. F., Mastin, T. B. (2014). Surveying Principles and Applications. *Pearson Education, 9th*. 978-0137009404.

### Other Learning Materials

Surveying Lab Manual, 2014 Edition.

### Minimum Qualifications

Engineering Technology (Masters Required)  
Engineering (Masters Required)  
Engineering Support

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