

**SURV 53 Course Outline as of Summer 2025****CATALOG INFORMATION**

Dept and Nbr: SURV 53 Title: ROUTE SURVEYING &amp; DESIGN

Full Title: Route Surveying &amp; Design

Last Reviewed: 12/13/2021

Units	Course Hours per Week		Nbr of Weeks		Course Hours Total	
Maximum	4.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	4.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	6.00		Contact Total	105.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00

Total Student Learning Hours: 210.00

Title 5 Category: AA Degree Applicable

Grading: Grade Only

Repeatability: 00 - Two Repeats if Grade was D, F, NC, or NP

Also Listed As:

Formerly: CEST 53

**Catalog Description:**

In this course students will study and perform route surveying and design, geometric design, and construction staking of transportation routes. Students will use electronic surveying equipment, computers, and data collectors. The course will include an introduction to photogrammetry and Global Positioning Systems (GPS).

**Prerequisites/Corequisites:**

Course Completion of APTE 191, CEST 51, and SURV 60

**Recommended Preparation:****Limits on Enrollment:****Schedule of Classes Information:**

Description: In this course students will study and perform route surveying and design, geometric design, and construction staking of transportation routes. Students will use electronic surveying equipment, computers, and data collectors. The course will include an introduction to photogrammetry and Global Positioning Systems (GPS). (Grade Only)

Prerequisites/Corequisites: Course Completion of APTE 191, CEST 51, and SURV 60

Recommended:

Limits on Enrollment:

Transfer Credit: CSU;

Repeatability: Two Repeats if Grade was D, F, NC, or NP

## **ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:**

<b>AS Degree:</b>	<b>Area</b>	Effective:	Inactive:
<b>CSU GE:</b>	<b>Transfer Area</b>	Effective:	Inactive:

<b>IGETC:</b>	<b>Transfer Area</b>	Effective:	Inactive:
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<b>CSU Transfer:</b>	Transferable	Effective:	Fall 1981	Inactive:
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<b>UC Transfer:</b>		Effective:		Inactive:
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**CID:**

**Certificate/Major Applicable:**

Both Certificate and Major Applicable

## **COURSE CONTENT**

**Student Learning Outcomes:**

At the conclusion of this course, the student should be able to:

1. Describe the route location process
2. Properly set up and operate data collection equipment and software
3. Lay out civil engineering designs
4. Prepare and use photogrammetric control in topographic mapping
5. Perform complex computations used in civil engineering construction

**Objectives:**

At the conclusion of this course, the student should be able to:

1. Develop a route location for a transportation project
2. Summarize the proper use of the total station and data collector software and hardware
3. Perform a field survey for control, topographic and planimetric surveys
4. Prepare maps, plats and drawings from field data
5. Prepare a photogrammetric surveying layout
6. Perform complex computations related to photogrammetric surveys, right-of-way acquisition surveys, roadway alignments, earthwork volumes, slope staking, and global positioning surveys
7. Design and lay out roadways using civil and surveying Computer Assisted Drafting and Design (CADD) software and hardware and surveying equipment
8. Perform a field survey to slope stake a roadway
9. Compute earthwork and other construction volumes
10. Prepare route surveying documentation for different types of projects

**Topics and Scope:**

- I. Route Location Process
  - A. Site reconnaissance
  - B. Ownership conflicts

- C. Boundary and easement issues
- D. Preliminary and topographic surveys
- E. Preliminary and final route design
- II. Control Surveys
  - A. Quality Control (QC), Quality Assurance (QA), and network planning
  - B. Datum, projection and coordinate system considerations
  - C. Primary and secondary control placement
  - D. Network densification
  - E. Statistical adjustment
- III. Data Collectors
  - A. Device configuration
  - B. Data upload for reconnaissance and stake-out
  - C. Data download for export to CADD
- IV. Photogrammetry
  - A. Basic theory
  - B. Aerial survey planning
    - 1. Neat model
    - 2. Image overlap and sidelap
    - 3. Image registration with survey data
- V. Highway Geometrics
  - A. Straightline segments
  - B. Curves: tangent circular, spiral, parabolic
    - 1. Curve geometry, layout and as-built check
    - 2. Vertical curvature, crown and drainage
- VI. Highway Design and Layout
  - A. Freeway, roadway, railway, city street, bridges
  - B. Perspectives: plan view, profile view, cross-section, end section
  - C. Point of Beginning (POB), stationing, centerline, alignment, cross-sections
  - D. Crown, slope and drainage
  - E. Grade and vertical curve considerations
- VII. Determining Construction Quantities
  - A. Area calculations: cross-sections, end area, plan area
  - B. Volume calculations: cross-section segments, vertical cuts and fills, borrow pits
- VIII. Slope Staking
  - A. Centerline elevations
  - B. Cross-sectional, cut and fill calculations
  - C. Stake marking (labeling placement and flagging)

## LABORATORY TOPICS AND SCOPE

- I. Topcon University - Educational Videos Route and Construction Surveying Methods
- II. Route Location Research Exercise
- III. Field Mapping and Data Collection Methods
  - A. Field notes and field books
  - B. Use of compass and tape
  - C. Field use of Terrestrial Positioning System (TPS) and Global Positioning System (GPS) surveying devices
    - 1. Mission Planning / Reconnaissance Techniques
    - 2. Types of devices and positional accuracy
    - 3. GPS data collection methods
      - a. Navigation
      - b. Measurement
      - c. GPS device dashboard and controls

- 4. TPS data collection methods
  - a. Navigation
  - b. Measurement
  - c. TPS device dashboard and controls
- IV. Simple, Reverse and Compound Curve Stakeout Exercise
- V. Radial Stakeout of a Roadway from Control Traverse Exercise
- VI. Median Island Stakeout Exercise
- VII. Bus Stop at Intersection Stake-out Exercise
- VIII. Storm Drain and Catch Basin Stake-out Exercise
- IX. Cul-de-Sac Curb and Gutter, Sanitary Sewer and Storm Drain Stake-out Exercise
- X. Elevation Certificate Research
- XI. Slope Staking Exercise
- XII. Photogrammetry Survey Planning Exercise
- XIII. Final Comprehensive Planning and Design Staking Exercise
- XIV. Office Processing of Field Data
  - A. Data download and storage
  - B. Data QC/QA, reduction, edits and preparation
  - C. Baseline and vector processing
  - D. Vector QC/QA, loop closure check
  - E. Adjustment of final solutions
  - F. Report preparation

**Assignment:**

- 1. Textbook reading (1-3 chapters per week)
- 2. Homework assignments (6-10)
- 3. Field work exercises, performance exams and reports (8-12)
- 4. Exam(s) (1-4)
- 5. Final exam

**Methods of Evaluation/Basis of Grade:**

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments and skill demonstrations are more appropriate for this course.

Writing  
0 - 0%

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problem sets, field work exercises and reports

Problem solving  
25 - 35%

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Field exercises and performance exams

Skill Demonstrations  
30 - 40%

**Exams:** All forms of formal testing, other than skill performance exams.

Exam(s) and final exam

Exams  
30 - 45%

**Other:** Includes any assessment tools that do not logically fit into the above categories.

Class participation

Other Category  
0 - 10%

**Representative Textbooks and Materials:**

Surveying with Construction Applications. 8th ed. Kavanaugh, B. Prentice Hall. 2014 (classic)  
Instructor prepared materials