

**APTECH 191 Course Outline as of Fall 2015****CATALOG INFORMATION**

Dept and Nbr: APTECH 191 Title: PROB SOLVING CIVIL TECH

Full Title: Problem Solving in Civil Engineering Technology

Last Reviewed: 1/25/2021

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	3.00	Lab Scheduled	0	8	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	3.00		Contact Total	52.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00

Total Student Learning Hours: 157.50

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:

**Catalog Description:**

Approaches to problem solving in Civil Engineering Technologies including quantitative reasoning coupled with direct applications to problems encountered in land surveying, civil engineering, GIS, construction and related engineering technologies.

**Prerequisites/Corequisites:****Recommended Preparation:**

Course Completion of MATH 150B OR MATH 151 OR Standard first year high school algebra course with "C" or better

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

Description: Approaches to problem solving in Civil Engineering Technologies including quantitative reasoning coupled with direct applications to problems encountered in land surveying, civil engineering, GIS, construction and related engineering technologies. (Grade Only)

Prerequisites/Corequisites:

Recommended: Course Completion of MATH 150B OR MATH 151 OR Standard first year high school algebra course with "C" or better

Limits on Enrollment:

Transfer Credit:

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

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

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

**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. Define and solve algebraic, geometric and trigonometric problems in the fields of civil engineering, land surveying, geospatial and construction technologies.
2. Describe and evaluate measurement data using descriptive statistics and exploratory data analysis.

### **Objectives:**

1. Solve problems involving triangles, polygons, curves and curve elements, terrestrial baselines (vectors), Global Positioning System, GPS signal vectors, matrices and measurement data.
2. Calculate curve elements, arc lengths and areas of sectors and segments.
3. Analyze and solve problems relating to the dimensions of geometric solids such as earth volumes, cut and fill, tailings, concrete forms.
4. Solve linear equations and inequalities with one, two or three variables such as those found in trilateration methods of GPS ranging.
5. Solve systems of equations through the use of graphing, addition, substitution and comparison as well as through the use of determinants and matrices.
6. Evaluate and solve ratio and proportion problems found in the civil engineering, land surveying, geospatial and construction fields.
7. Evaluate and summarize measurement data using descriptive statistics and exploratory data analysis methods.

### **Topics and Scope:**

- I. Review of fundamental concepts found in geospatial problem solving
  - A. Real number system
  - B. Scientific notation and engineering notation

- C. Exponents and radicals
- E. Algebraic expressions and properties
- F. Linear equations
- G. Ratio and proportion
- II. Review of graphing concepts
  - A. Functions used in land surveying
  - B. Graphing linear equations
  - C. Distance and slope formulas
  - D. Coordinate systems used in geospatial mapping
- III. Review of geometric concepts
  - A. Lines, angles, distance and direction
  - B. Triangles, quadrilaterals, polygons, circles, ellipses and other geometric figures
    - 1. Orientation
    - 2. Areas
    - 3. Volumes
  - C. Arcs, arc length and curves
    - 1. Arc definitions
    - 2. Curve types and curve elements
    - 3. Rays and cardinal points
  - D. Vectors and scalars
    - 1. Vector components
    - 2. Vector and scalar arithmetic
    - 3. Complex numbers
- IV. Review of trigonometric concepts
  - A. Trigonometric functions of an angle
  - B. Radians and angular measure
  - C. Right triangle solutions: Pythagorean Theorem
  - D. Oblique triangle solutions: Law of Sines/Cosines, identify ambiguities
  - E. Application of trigonometric functions to:
    - 1. Angular and linear measures
    - 2. Areas and volumes
    - 3. Arc distances, curve lengths, and curve elements
    - 4. Express scalar and vector quantities
    - 5. Graphing simple trigonometric functions
- V. Review of systems of linear equations found in surveying and geospatial problems
  - A. Examples of linear equations and systems of linear equations
  - B. Methods of solving systems of linear equations
    - 1. Algebraic solutions, graphing
    - 2. Vector solutions, matrices and determinants
  - C. Obtaining multiple solutions for simple 2 and 3 variable systems of equations
- VI. Review of descriptive statistics in civil engineering, surveying and GIS
  - A. Populations, samples and distributions
  - B. Summarizing central tendency and spread
  - C. Other statistical moments
  - D. Parametric vs. non-parametric statistics
  - E. Univariate vs bivariate descriptions
  - F. Characterize and assess data quality with descriptive statistics
  - G. Present statistical summaries with diagrams, charts and graphs
- VII. Measurements and measurement theory in civil engineering, surveying and GIS
  - A. Measurement theory and methods
  - B. Error assessment and error management
  - C. Summarizing measurement variability

D. Assess error associated with measurements and measuring devices

#### VIII. Calculation methods and tools

- A. Hand calculator
- B. Spreadsheets
- C. Software applications

#### Assignment:

- 1. Readings (20-40 pages per week)
- 2. Problem sets (1-2 per week)
- 3. Quizzes (2-4)
- 4. Exams (4-8)
- 5. Quantitative Skill Demonstrations (2-6)

#### 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.

Problem sets

Problem solving  
40 - 50%

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

Quantitative Skill Demonstrations

Skill Demonstrations  
5 - 10%

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

Objective examinations (multiple choice, true false, matching, completion, etc.), Quizzes

Exams  
40 - 50%

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

None

Other Category  
0 - 0%

#### Representative Textbooks and Materials:

Trigonometry for Engineering Technology, 2013 Author: Gary Powers, Publisher: Industrial Press Inc.

Elementary Technical Mathematics, 11th edition, 2014 Authors: Dale Ewen and Robert Nelson, Publisher: Prentice Hall

Basic Technical Mathematics, 10th edition, 2013 Author: Allyn Washington. Publisher: Pearson

Technical Mathematics, 6th Edition 2011, Author: Paul Calter and Michael Calter, Publisher: Wiley (classic)