**APTECH 191 Course Outline as of Summer 2022**

# 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

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| 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, Geographic Information Systems (GIS), construction, and related engineering technologies.

**Prerequisites/Corequisites:**

**Recommended Preparation:**
Course Completion of MATH 150 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, Geographic Information Systems (GIS), construction, and related engineering technologies. (Grade Only)

Prerequisites/Corequisites:
Recommended: Course Completion of MATH 150 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:

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|---|---|---|---|
| **AS Degree:** | **Area** | Effective: | Inactive: |
| **CSU GE:** | **Transfer Area** | Effective: | Inactive: |
| **IGETC:** | **Transfer Area** | Effective: | Inactive: |

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| **CSU Transfer:** | Effective: | Inactive: |
| **UC Transfer:** | Effective: | Inactive: |

**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 trigonomentric 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:**
At the conclusion of this course, the student should be able to:
1. Solve problems involving triangles, polygons, curves and curve elements, terrestrial baselines (vectors), Global Positioning Systems (GPS), 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, and concrete form work.
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 by using various methods.
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
D. Algebraic expressions and properties
E. Linear equations
F. 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 and identification of ambiguities
E. Application of trigonometric functions
1. Angular and linear measures
2. Areas and volumes
3. Arc distances, curve lengths, and curve elements
4. Expressing scalar and vector quantities
5. Graphing simple trigonometric functions

V. 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 and graphical solutions
2. Graphing, addition, substitution, comparison, and determinants and matrices
3. 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. Spreadsheet applications
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.

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| 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<br>0 - 0% |

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

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| Problem sets | Problem solving<br>40 - 50% |

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

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| Quantitative skill demonstrations | Skill Demonstrations<br>5 - 10% |

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

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| Examinations and quizzes | Exams<br>40 - 50% |

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

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| None | Other Category<br>0 - 0% |

**Representative Textbooks and Materials:**

Elementary Technical Mathematics. 12th ed. Ewen, Dale and Nelson, Robert. Prentice Hall. 2019
Basic Technical Mathematics. 11th ed. Washington, Allyn. Pearson. 2018
Technical Mathematics. 6th ed. Calter, Paul and Calter, Michael. Wiley. 2011 (classic)
Technical Mathematics. 7th ed. Peterson, John. Cengage. 2019