Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: James Bae **Date:** 11/12/2020

Department	Subject	Course Number	Title
Engineering: Technologies	Engineering: Technologies ENGR	565	Plane Surveying II (formerly ENGR-165)

Units/Hours

Each lecture unit requires 1 hour per week of class time, and 2 hours per week of study outside of class.
Each laboratory unit requires 3 hours per week of class time.
Each activity unit requires 2 hours per week of class time and 1 hour per week of study outside of class.

Lecture Units	Lab Units	Total Units
2.50	0.50	3.00
Lecture Contact Hours	**Lab Contact Hours**	**Total Contact Hours**
40.00 - 45.00	24.00 - 27.00	64.00 - 72.00
Lecture Homework Hours	**Lab Homework Hours**	
80.00 - 90.00	0	

Stand Alone:

Program Applicable

AA/AS Degree General Ed Breadth Area(s):

-none-

General Education Justification:

Maximum Enrollment: 25

Maximum Enrollment Justification: Justification:

Grading Method: Letter Grade or P/NP

TOP code: 0957.30*

Can be Taken 1 **time(s) for credit** (max 4)

- [ ] - Visual or Performing Arts course that is required to meet major requirements for UC/CSU
- [ ] - Intercollegiate athletics course
- [ ] - Academic/vocational competition course

Catalog Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**75 words** or less in gray box below).

This advanced course is a continuation of Plane Surveying I and designed for students seeking a career in surveying and engineering. Students will compute horizontal and vertical curves, earthworks, and adjustment of level nets. Students will be introduced to the Public Land Survey System, California Coordinate System, easements and property descriptions, astronomic observations, Global Information System, and photogrammetry.

Schedule Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**25 words** or less in gray box below).

This course is to provide students with advanced understanding of surveying applications which includes State Plane Coordinates, Public Land Surveys, and advanced computations.

Need for the course:

This course provides the student with foundational skills to be immediately employable at an entry level in County and Commercial construction surveying and drafting. This may also support further education in Engineering, Geographic Information System mapping and Environmental Engineering. It is one course of a series of courses required for a student to be awarded AS or Certificate in Engineering: Drafting Technology. The Center of Excellence for Labor Market Research (California Community Colleges) estimates that entry-level Engineering Technology jobs (Civil, Electrical, Industrial, Mechanical, amongst other Technicians) will continue to grow in the Inland Empire/San Bernardino area from 2018-2023 by 3%, while offering positions earning above estimated â€œliving wageâ€ rates. This estimated 300 annual jobs outpaced the awards given at the time by local community colleges. This indicates a major opportunity for MSJC to continue to provide entry level Engineering job training, while growing the program to more advanced training to support professional training in the future. This course supports and is attached to: ENGR - Engineering: Drafting Technology - Certificate (Elective), ENGR - Surveying - Employment Concentration (Required)

Prerequisite(s):

Prerequisites go through a separate approval process. See Forms E1-E6 for details.
(For further clarification, contact the Prerequisite Subcommittee)

- ENGR 164 with a Grade of C or better.

Corequisite(s):

Corequisites go through a separate approval process. See Forms E1-E6 for details.

-none-

Recommend Preparation:

Recommended Preparation goes through a separate approval process. See Forms E1-E6 for details.

-none-

Other Enrollment Criteria:

-none-

Learning Objectives:

(please number each objective and express in behavioral terms)

Upon the completion of the course the student will be able to do the following:

1. Apply surveying mathematics to calculate trigonometric, curve, area, direction and slope functions.
2. Calculate advanced mathematical equations for spiral, vertical and superelevation curves.
3. Diagram and differentiate different aspects and principles of the Public Land Survey Systems.
4. Analyze and interpret the basics of boundary law and property surveys for understanding legal descriptions of boundaries, deeds, easements, subdivisions and so on.
5. Differentiate between various types of survey techniques, such as hydrography versus mineral surveys.
6. Assess and integrate photogrammetry into a surveying application while recognizing potential errors due to ground coverage, base height ratio, scale and relief displacement.
7. Analyze and discuss the relevance of astronomical techniques, including but not limited to the advancements made with EDM and GPS.
8. Consider and explain the ethical and legal limitations of surveyors when consulting with a potential client.

Course Content:

(please number the outline of main topics and subtopics)

1. Surveying Mathematics
    1. Definitions and Unit Conversions
    2. Trigonometry
    3. Horizontal Curves
    4. Areas Bounded by Curves
    5. Vertical Curves
    6. Areas and Volumes
    7. Adjustments
    8. Directions
    9. Slope Intercepts
2. Advanced Mathematics
    1. Quadratic Equations
    2. Simultaneous Equations
    3. Areas
    4. Vertical Curves
    5. Curve Superelevation
    6. Spiral Curves
3. Land Boundary Law
    1. A. Boundary Law Terms
    2. Deeds
    3. Unwritten Rights
    4. Easements
    5. Proportionment
    6. Water Boundaries
    7. Testimony
    8. Order of Call and the Priority of Monuments
4. Surveying Astronomy
    1. Astronomical Coordinate Systems
    2. Geographical Coordinates and their Elements
    3. The PZA Triangle
    4. The Earth’s Orbit and the Ecliptic
    5. Solar Observation for Azimuth
    6. Parallax, Refraction and the Semidiameter of the Sun
    7. Observations of Polaris
    8. Observation for Latitude

9. The Equation of Time
10. Zone Time
11. Sidereal Time
12. Global Positioning Systems

5. Photogrammetry
    1. Formats and Cameras
    2. Scale
    3. Relief Displacement
    4. Overlap and Base Height Ratio
    5. Ground Coverage
    6. Planning Aerial Photography
    7. Artificial Targets
6. Boundary Law and Property Surveys
    1. Land Survey Profession
    2. Concepts Related to Real Property
    3. Land Survey Systems
    4. Descriptions and Plats
    5. Boundary Establishment Methods
    6. Boundary Retracement Concepts and Principles
    7. Land Survey Practices
    8. Land Survey Evidence
7. Subdivision of Land
    1. Land Subdivision and Platting
    2. Subdivision Design Principles and Standards
    3. Engineering Aspects of Land Subdivision
8. Resurveys
    1. Lotting
    2. Exceptions and Discrepancies in the Public Record
    3. Rights of Possession in Public Lands
    4. Meandering
    5. Mineral Surveys
9. Hydrography
    1. Flow Measurement
    2. Hydrography at Sea
    3. Hydrographic Maps
10. Professional Practice and Project Management
    1. Client Relations
    2. Ethics and Liability
    3. Economics
    4. Licensing
11. The NCEES Exam
    1. Question Styles and Formats
    2. Analysis of questions
    3. Preparation for the Exam
    4. Taking the Exam

Lab Content:

(please number the outline of main topics and subtopics)

1. Surveying Mathematics
    1. Definitions and Unit Conversions
    2. Trigonometry
    3. Horizontal Curves
    4. Areas Bounded by Curves

5. Vertical Curves
6. Areas and Volumes
7. Adjustments
8. Directions
9. Slope Intercepts

2. Advanced Mathematics
    1. Quadratic Equations
    2. Simultaneous Equations
    3. Areas
    4. Vertical Curves
    5. Curve Superelevation
    6. Spiral Curves
3. Land Boundary Law
    1. Boundary Law Terms
    2. Deeds
    3. Unwritten Rights
    4. Easements
    5. Proportionment
    6. Water Boundaries
    7. Testimony
    8. Order of Call and the Priority of Monuments
4. Surveying Astronomy
    1. Astronomical Coordinate Systems
    2. Geographical Coordinates and their Elements
    3. The PZA Triangle
    4. The Earth’s Orbit and the Ecliptic
    5. Solar Observation for Azimuth
    6. Parallax, Refraction and the Semidiameter of the Sun
    7. Observations of Polaris
    8. Observation for Latitude
    9. The Equation of Time
    10. Zone Time
    11. Sidereal Time
5. Photogrammetry
    1. Formats and Cameras
    2. Scale
    3. Relief Displacement
    4. Overlap and Base Height Ratio
    5. Ground Coverage
    6. Planning Aerial Photography
    7. Artificial Targets
6. Boundary Law and Property Surveys
    1. Land Survey Profession
    2. Concepts Related to Real Property
    3. Land Survey Systems
    4. Descriptions and Plats
    5. Boundary Establishment Methods
    6. Boundary Retracement Concepts and Principles
    7. Land Survey Practices
    8. Land Survey Evidence
7. Subdivision of Land
    1. Land Subdivision and Platting
    2. Subdivision Design Principles and Standards
    3. Engineering Aspects of Land Subdivision

8. Public Land Survey System
    1. Initial Point
    2. Establishment of townships and sections
    3. Rights of Possession in Public Lands
    4. Meandering
9. California Coordinate System
    1. Understanding the system
    2. Difference between 1927 and 1983 system
    3. Practical application
10. Global Positioning System
    1. How developed
    2. Existing useages
    3. Survey application
11. The NCEES Exam
    1. Question Styles and Formats
    2. Analysis of questions
    3. Preparation for the Exam
    4. Taking the Exam

Methods of Instruction:

Methods of instruction may include, but are not limited to the following:

- **Method:** Quizzes and exams
  Integration: Quizzes and exams with a variety of question formats will be used to assess student comprehension of surveying techniques, applications, and to assess student ability to think critically about the appropriateness of techniques for particular survey applications. Quizzes can be used for in-class practice and immediate feedback by instructor.
- **Method:** Observation and Demonstration
  Integration: In-class demonstrations and lecture, with in-class participation including feedback and evaluation by the instructor. For example, students may be given handouts and guided through an application that utilizes the equipment. In this way, the instructor can assist students in understanding assigned readings while utilizing and interpreting various concepts.
- **Method:** Homework assignments and collaborative projects
  Integration: Assist students in understanding, assimilating and adapting a variety of surveying technology into their knowledge base.
- **Method:** An instructor led final project
  Integration: Presents students with an opportunity to interact one-on-one with the instructor or as a collaborative team. Feedback and evaluation can be facilitated by the instructor while assessing student ability to integrate the content of the course in a surveying application that is a real-world engineering scenario.
- **Method:** Field Experience
  Integration: Field exercises provide students with hands-on experience using precision techniques for surveying. Field exercises provide students an opportunity to demonstrate technical skills acquired in this course.
- **Method:** Online Activity/Discussion
  Integration: Online activity resources, software tutorials and interactive simulations will teach State Plane Coordinates and Photogrammetry.
- **Method:** Lecture
  Integration: Class time lectures and presentations will be used to teach the concepts of coordinate systems, trigonometric computation, legal requirements, and types of measurement.
- **Method:** Readings
  Integration: Directed reading about technology, application and legal requirements and interpretations on surveying.
- **Method:** Film/video Viewing and Discussion
  Integration: Viewing and discussion of videos covering surveying techniques, equipment and applications in civil engineering.

Methods of Evaluation:

A student's grade shall be determined by the instructor using multiple measures of performance related to the course objectives. Methods of evaluation may include but are not limited to the following:

- **Method:** Quizzes
  Integration: Quizzes objectively assess student comprehension of surveying techniques and applications for a variety of scenarios.
- **Method:** Class Participation
  Integration: In-class participation offers students an opportunity to demonstrate understanding of the course content while working as a team or with the instructor.
- **Method:** Homework
  Integration: Weekly homework assignments will test student comprehenshion and application of the technology and theory, as stated in the course content, to various problem solving situations.
- **Method:** Field exercises
  Integration: Will test student understanding of in-field functionality of surveying equipment and application of concepts to real world situations.
- **Method:** Group Projects
  Integration: A group project provides students an opportunity to demonstrate excellence in organization and cooperation. The project will be peer evaluated for individual student participation and instructor evaluated for conceptual, methodological, technical validity and accuracy.
- **Method:** Supplementary activities
  Integration: Software tutorials and simulations, may be assigned for additional demonstration of student skills, when relevant to the course objectives. Will be evaluated by topic used and topic content along with presentation procedure.

Examples of Assignments:

Students will be expected to understand and critique college level texts or the equivalent. Reading and writing, as well as out of class assignments are required. These assignments may include but are not limited to the following:

1. Given the attached survey example, assess the trigonometric error(s). Choose the correct mathematical equation to correct or adjust the error(s).
2. As shown in the diagram, calculate the slope in degrees between points A and B. Draw a profile for the slope for A and B. Convert the slope to a percentage value.
3. Convert the uncorrected data collected with the EDM in the field from State Planes to Universal Transverse Mercator Projection and import it into a Computer Aided Drafting or Geographic Information Systems. Using an automated mapping system, adjust the coordinate geometry. Describe your method for adjusting the survey geometry.
4. Summarize the in-class presentation of Global Positioning Systems impact to the field of surveying. Compare the astronomical technique used for triangulation with GPS to the triangulation employed by Electronic Distance Measuring devices. Assess accuracy differences between the two devices, as demonstrated during the field exercise.
5. Without locating the site in the field, use the topographic map to draw the area described in the attached legal description to draw the boundaries of the parcel on to the attached aerial photograph. Describe the mathematical calculation that you would use to correct for any errors and defend your choice. What are the pros and cons for using this method for identifying the legal limits of a client’s parcel boundaries?

Textbooks:

- Ghilani, C.D., Wolf, P.R. (2014). *Elementary Surveying An Introduction to Geometrics* Prentice Hall. ISBN: 9780133758887
- Ghilani, C. (2017). *Elementary Surveying: An Introduction to Geomatics (15th Edition)* Pearson. ISBN: 0134604652
- Cole, G.M. (2017). *California Civil Surveying Reference Manual* PPI - Kaplan. ISBN: 1591264944

Other Resources:

Minimum Qualification

- Engineering (Masters Required) **or**
- Engineering Support **or**
- Engineering Technology (Masters Required)