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	164	Plane Surveying I

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: 32

Maximum Enrollment Justification:

Course requires significant individualized instruction or assessment â€“ check all that apply:

*** Course relies on small group dynamics as a means of instruction or assessment.**

*** Course requires that each student be evaluated individually on a set of**

	skills more than twice per semester. **Justification: Hands on project based learning occurs in the classroom as well as in the laboratory, which depends on small group dynamics. Students are individually assessed on various skills learned in the class.**
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 course will cover surveying fundamental skills which includes; use and proper care of surveying instruments, horizontal, vertical and angular measurements, layout and traverse procedures, computation, analysis, and adjustments of the traverse. Students will also get an introduction to the Public Land Survey System, State Plane Coordinates, Global Positioning System, and state/local laws.

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 introduces students to the fundamentals of plane surveying with the use of various measuring and calculating instruments for mapping in the field.

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 the following awards: ENGR - Surveying - Employment Concentration (Required), ENGR - Engineering: Drafting Technology - Certificate (Elective)

Prerequisite(s):

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

-none-

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.

- MATH 094 or
- MATH 096 or
- MATH 096B

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. Calculate area and linear measurements, horizontal and vertical angle measurements, direction and leveling measurements.
2. Derive the calculations for coordinates for a traverse and determine the error.
3. Examine a legal description based on the Public Land Survey System.
4. Demonstrate field survey skills using a variety of survey instruments.
5. Analyze and rectify errors in survey measurements.
6. Formulate a plan for a field survey given extreme terrain and poor weather conditions.
7. Demonstrate and understand the basic applications of datum, traverse, level, plane table and stadia.
8. Manipulate and integrate map projection, coordinate and field control data for a plane survey map area into an automated mapping system, such as Computer Aided Drafting or Geographic Information Systems.
9. Create a set of field notes so as to have a plat or topographic map drawn up to reflect the data performed during lab.
10. Choose the type of equipment needed based on the type of survey being performed
11. Solve surveying applications using algebra, trigonometry and geometry

Course Content:

(please number the outline of main topics and subtopics)

1. Basic Surveying and Mapping Concepts
    1. Earth Geometry
    2. Surveying Mathematics
    3. Angles and Directions
    4. Corrections and Errors
    5. Contours and Mapping
2. Surveying Computations
    1. Traverse and Coordinate Calculations
    2. Basic Triangulation
    3. Route Surveying Calculations
    4. Area Calculations
3. Measurements and Field Techniques
    1. Field Surveying Procedures
    2. Surveying Instruments
    3. Linear Measurements
    4. Angle Measurements

5. Direction Measurements
6. Traversing and Field Control
7. Leveling Measurements
8. Field Operations
9. Datum

4. Survey Applications
    1. Engineering and Construction Surveys
    2. Geodetic Control Surveys
    3. Topographic Surveys
    4. Mine and Underground Surveys
5. Surveying Instruments and Procedures
    1. Definitions
    2. Field Notes
    3. The Compass
    4. Optics
    5. The Level and the Rod
    6. Grading and Leveling
    7. Transits and Theodolites
    8. Taping
    9. Stadia
    10. EDM
    11. Route Staking
    12. Errors and Statistics
6. Public Land Surveying System
    1. History of Public Lands
    2. Gunter's Chain
    3. The Solar Compass
    4. Manual of Instructions
    5. Limits and Adjustments
    6. The Quadrangle
    7. The Township
7. Plats and Mapping
    1. Map Types and Symbols
    2. Map Scales
    3. Topographic Mapping
    4. Plats
    5. ALTA/ACSM Land Title Survey Plats

Lab Content:

(please number the outline of main topics and subtopics)

1. Basic Surveying and Mapping Concepts
    1. Earth Geometry
    2. Surveying Mathematics
        1. Linear measurements,
        2. Horizontal and vertical angel measurements
        3. Direction and Leveling measurements
        4. Calculations for coordinates for a traverse, determine error and rectify
    3. Angles and Directions
        1. Horizontal and vertical angel measurements
    4. Corrections and Errors
    5. Contours and Mapping
2. Surveying Computations
    1. Traverse and Coordinate Calculations and error

2. Basic Triangulation
3. Route Surveying Calculations
4. Area Calculations
5. Algebra calculations
6. Trigonometry calculations
7. Geometry calculations

3. Measurements and Field Techniques using a variety of survey instruments
    1. Field Surveying Procedures
    2. Surveying Instruments
    3. Linear Measurements
    4. Angle Measurements
    5. Direction Measurements
    6. Traversing and Field Control
    7. Leveling Measurements
        1. Datum
        2. Traverse
        3. Level
        4. Plane table
        5. stadia
    8. Field Operations
        1. Good weather conditions
        2. Extreme and poor weather conditions
    9. Datum
4. Survey Applications
    1. Engineering and Construction Surveys
    2. Geodetic Control Surveys
    3. Topographic Surveys
    4. Mine and Underground Surveys
    5. Integrate map projections, coordinate and mapping systems for CAD and GIS
5. Surveying Instruments and Procedures
    1. Definitions
    2. Field Notes
    3. The Compass
    4. Optics
    5. The Level and the Rod
    6. Grading and Leveling
    7. Transits and Theodolites
    8. Taping
    9. Stadia
    10. EDM
    11. Route Staking
    12. Errors and Statistics
6. Public Land Surveying System
    1. History of Public Lands
    2. Gunter’s Chain
    3. The Solar Compass
    4. Manual of Instructions
    5. Limits and Adjustments
    6. The Quadrangle
    7. The Township
    8. Legal Descriptions
7. Plats and Mapping
    1. Map Types and Symbols
    2. Map Scales

3. Topographic Mapping
4. Prepare field notes for Plat and topo mapping of the field survey
5. ALTA/ACSM Land Title Survey Plats

Methods of Instruction:

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

- **Method:** Lecture
  Integration: Lectures with supporting demonstrations will be used to introduce survey applications, field techniques, plats and mapping.
- **Method:** Lab Activities
  Integration: Lab activities will allow students to apply the concepts learned in class by performing surveying activities, documenting data, and solving practical, real-world problems similar to what an engineer and surveyor would face in the industry.
- **Method:** In-class Exercises
  Integration: In-class exercises provide students with the opportunity to become familiar with variety of surveying technology such as datum, traverse, and leveling.
- **Method:** Discussion
  Integration: Discussions will be integrated in the presentation to explore the areas of mathematics, equipment usage, and survey principles.

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 will be given to assess the student comprehension of surveying techniques and applications, for a variety of scenarios with linear, angular and leveling measurements.
- **Method:** Class Participation
  Integration: Participating in large and small groups in class allows for working as a team or with the instructor to discuss in depth the equipment needed based on the type of survey being performed. Students will be assesed on participation and understanding of material.
- **Method:** Field exercises
  Integration: A field exercise allows the student first hand experience in understanding of in-field functionality of surveying equipment and application of concepts to real world situations while collecting data and performing field notes. Students will be assessed on relevance of data and accuracy of field notes compared to common professional practice and expectations as outlined in class.
- **Method:** Group Projects
  Integration: Students work in a crew while preparing field notes that will reflect coordinates and elevations of the crew site. Project presents students with an opportunity to interact one-on-one with the instructor or as a collaborative team, thus assessing student ability to integrate the content of this course in a surveying application that is a real-world engineering scenario.
- **Method:** Homework
  Integration: Activities such as software tutorials for legal description for worked performed on the public land survey system and simulations, may be assigned as home work. Students will be assessed for comprehension through a quiz or short essay.

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:

A. Design a Complete Traverse Report for a Topographic Survey

1. Lay out a 5 sided traverse, measuring interior angles and horizontal distances.
2. Location must include elevations coming off of an established benchmark.
3. An established basis of bearings must be used to provide a common reference.
4. Compute the coordinates, closure area and determine precision of closed figure.
5. Compile the report using industry standard format set by the Federal Geographic Data Commitee.

B. Presentation on Survey Plat and Traverse Computation

1. This oral presentation will be 10 -15 minutes in length and will include the use of presentation software (e.g. Powerpoint, Slides).
2. Create a survey plat of a local area. Provide a complete map, drawn to scale, showing how the piece of land is divided.
3. Perform traverse computations.
4. Discuss methods, procedures, and challenges encountered in laying out your field traverse.
5. Provided a comparison of the angular and linear precision with both State and Federal standards.

Textbooks:

- United States. Bureau of Land Management (2016). *Manual Of Instructions For The Survey Of The Public Lands Of The United States* Lulu . ISBN: 9781365076701
- Ghilani, C. D., Wolf, P. R. (2017). *Elementary Surveying An Introduction to Geometrics* Prentice Hall. ISBN: 9780134604657
- Ghilani, C. D. (2018). *Elementary Surveying - With Access - 15th edition* Pearson. ISBN: 9780134604657
- Wirshing, James R. and Roy H. Wirshing (1985). *Introductory Surveying* McGraw-Hill. ISBN: 0070711240

Other Resources:

Minimum Qualification

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