Lecture Contact Hours: 48-54; Outside-of-class Hours: 96-108;
Laboratory Contact Hours: 48-54; Outside-of-class Hours: 0;
Total Student Learning Hours: 192-216

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Surveying 240 – Advanced Surveying

3 hours lecture, 3 units
3 hours laboratory, 1 unit
Total units: 4

Catalog Description
Topographic, hydrographic and geodetic surveying. Precise equipment and control surveying, city and land surveys. Astronomical observations. State plane coordinates system. Route location and layout, transition, horizontal and vertical curves. Introduction to electronic and photogrammetric methods. U.S. Public Land Surveys and legal descriptions, and an introduction to Global Positioning Systems (G.P.S.).

Prerequisite
"C" grade or higher or "Pass" in SURV/ENGR 218 or equivalent

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Demonstrate the proper care and use of surveying instruments.
2) Calculate the area of a closed figure using the double meridian and least squares method.
3) Demonstrate knowledge of the North American Datum (N.A.D. '83) co-ordinate system.
4) Understand the methods of differential and profile leveling.

Course Content
1) Precise Equipment and Surveys
    a. Horizontal control
        1. Degrees of precision, methods of control, methods of observation, signals, errors and corrections
        2. Triangulation: the theodolite, its operation, capabilities and the running of a small scale control net
        3. Trilateration: "Electrotape," operation principles and the running of a large control net
    b. Vertical Control and Precise Leveling
        1. Accuracy, methods of observations, types of equipment, errors and corrections, barometric leveling
        2. Precise leveling: Use of self-leveling level and precise level in the establishment of elevation and vertical control points
        3. Trigonometric leveling: use of the theodolite
2) Astronomical Observations: Determination of precise time of day, longitude, and latitude utilizing both solar and night observation
3) Hydrographic Surveying: Determination of shoreline, mean tide lines, underwater topography, volumes and distribution of dredged material
4) Photogrammetry: Introduction to methods; means of control; data reduction and map production
5) Mapping and Coordinate Systems
    a. Mapping: Types of projections, their uses, advantages and disadvantages
    b. Coordinate systems: applications to surveying mapping and legal descriptions

Course Objectives
Students will be able to:
1) Understand and experience standard surveying through a series of office problems and associated field problems.
2) Practice techniques and problems involved in the production of precise surveys of both large and small scale.
3) Apply the principles of surveying to several important but specialized subfields of surveying and land mapping.
4) Plan a given survey, direct the taking of field data in an orderly and efficient fashion, and perform the necessary reduction of field data and/or mapping required by the given problem.

Method of Evaluation
A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.
1) Office work that measures student's ability to provide standard solutions toward surveying office works and related field problems.
2) Homework that measures student's capability of providing sensible practical solutions involved in the production of precise measurements in both small and large scale.
3) Quizzes, exams, final exam that measures student's understanding and application of the principles of surveying to several important but specialized subfields of surveying and land mapping.
4) Field book and field performance measure how the students will handle a job in the field - plan a given survey, direct the taking of field data in an orderly and efficient fashion, and perform the necessary reduction of field data and/or mapping required by the given problem.

Special Materials Required of Student
1) Field book
2) Scientific calculator
3) Engineer's scale, triangle, protractor

Minimum Instructional Facilities
1) Standard classroom with writing board, overhead projector/screen
2) Drafting tables and drafting machines
3) Digital computer, applicable software

Method of Instruction
Emphasis will be on the ability of the student to correlate the operation and application of equipment with the results desired from the particular survey or map. The lecture portion will concentrate on the theoretical grounding, both mathematical and physical, of the instruments and their applications with special emphasis placed on the identification of potential sources of error and the methods by which these errors may be eliminated or compensated. The associated fieldwork will consist of a series of practical problems based on a written specification of the desired results. Notekeeping and data reduction will be in accordance with locally accepted practice insofar as possible. Emphasis will be on the responsibility of the surveyor for the production of accurate and properly recorded work and the development of respect for the equipment, its capabilities, limitations and value. The following items are required as part of instructional tools:
1) Four theodolites, two self-leveling levels, two precise levels, two engineer's transits and rental fees for at least a two week use of electrotape or equivalent equipment, and associated night lighting equipment, smoked lens, level rods and targets
2) Lovar tape with NBS traceability and tape calibration bench
3) Four sets of chaining gear
4) Miscellaneous gear: hand levels, planimeters, stakes, flagging tape, lumber, cloth and other materials required for the construction of large scale projects

5) Six handie-talkies

Out-of-Class Assignments
1) Reading assignments
2) Individual and group projects

Texts and References
1) Required (representative example): Mastin, T., Kavanagh, B., *Surveying: Principles And Applications, 9th Edition*, 2021, ISBN-13: 978-9353062460
2) Supplemental: None

Exit Skills
Students having successfully completed this course exit with the following skills, competencies and/or knowledge:
1) Demonstrate understanding of the principles of photogrammetry.
2) Demonstrate use of electronic distance measuring equipment and radial staking.
3) Read and write legal descriptions.
4) Demonstrate understanding of Global Positioning System (G.P.S.).

Student Learning Outcomes
Upon successful completion of this course, students will be able to:
1) Demonstrate standard surveying practices through a series of office problems and associated field problems.
2) Practice techniques and problems involved in the production of precise surveys of both large and small scale.
3) Apply the principles of surveying to several specialized subfields of surveying and land mapping.
4) Plan a given survey, direct the acquisition of field data in an orderly and efficient fashion, and perform the necessary reduction of field data and/or mapping required by the given problem.