ENGR 2240

Division: Natural Science and Mathematics
Department: Engineering and Computer Science
Course: ENGR 2240
Title: Surveying and Global Positioning
Catalog Description:

Laboratory and lecture class including use of transit, level, total station, and other equipment in field surveying. Also covered are field astronomy, calculation procedures, state plane coordinates, public-land division, and an introduction to Global Positioning Systems (GPS) and Global Information Systems (GIS). A service learning component allows students to use their skills to serve the community.

General Education Requirements: N/A
Semesters Offered: Fall
Credit/Time Requirement: Credit: 3; Lecture: 2; Lab: 3
Clock/Hour Requirements: 0
Offered for Non-Credit: No
Prerequisites: MATH 1060 or high school trigonometry

Justification:

This course is designed as a component of the standard pre-professional curriculum in engineering, which enables the student to transfer with junior-level status into a four-year engineering program. Similar courses are offered in university engineering schools. For instance, it will transfer to Utah State University as CEE 2240, and at the University of Utah it corresponds to MG EN 1400. This course is to be taken during the freshman or sophomore year of the pre-engineering curriculum and will prepare the student for subsequent course work. This course could also be used by local surveying companies to further train their employees.

Student Learning Outcomes:

After completing this course, a student should: A. Be able to apply previously-studied math skills and physical principles to practical surveying problems. B. Be able to operate effectively a total station, a transit, a Geoexplorer II handheld GPS unit and associated software, and an automatic level. C. Have the skills to run a line of levels, a profile, simple traverses, astronomical sitings, and horizontal and vertical curves. D. Understand much of the nomenclature of surveying. E. Understand the use of state plane coordinates and be able to use them. F. Be prepared to take more advanced courses in surveying.

Content:

1. Introduction to Surveying a. Basic Definitions b. Errors vs Mistakes c. Basic Data Procedures 2. Measurement of Horizontal Distances a. Taping and Chaining and the applying of Correction Factors b. Electronic Distance Measuring Instruments (EDM s) and their Use3. Leveling a. Curvature and Refraction b. Trigonometric Leveling c. Setting up a Level d. Running a Line of Levels and Making Corrections e. Three-wire Leveling 4. Measurement of Angles a. Use of a Transit b. Double Centering c. Sources of Error d. Vertical and Zenith Angles e. Use of Total Stations5. Random Errors a. Simple Adjustment of Measurements b. Adjustment of Weighted Measurements6. Field Operations with a Transit a. Measuring Interior Angles, Angles

to the Right, and Deflection Angles b. Straight Line Extension by Double Centering c. Random Lines, Intersection of Two Straight Lines, and Obstacles on a Line d. Parallel Lines and Location of a Point7. Direction of a Line a. Meridians, Azimuths and Bearings b. Magnetic Compasses and Declinations8. Traverse Surveys and Computations a. Open and Closed Traverses b. Azimuth and Angle Traverses c. Referencing and Calculating Traverses d. Balancing and Adjusting9. The Global Positioning System a. The Fundamentals of GPS b. Differential and Kinematic GPS c. Surveying with GPS10. State Plane Coordinate and Universal Traverse Mercator Systems a. Basis of Each System b. Converting Between Systems by Calculations and Using CORPSCON11. Practical Astronomy a. Nomenclature b. Use of an Ephemeris and Where to Find One on the Internet c. Latitude and Azimuth from Observation on Polaris at any Hour Angle d. Azimuth from Altitude or Hour Angle of the Sun at any Hour12. Horizontal and Vertical Curves a. General Nomenclature of Curve Layouts b. Calculation and Layout of Horizontal and Vertical Curves13. Tacheometry a. Principle of Stadia Measurement b. Determination of Stadia Constants and Interval Factors c. Stadia Traverses d. Stadia Leveling14. Photogrammetry a. Types of Aerial Photographs b. Stereoscopy c. Orthophotos and Digital Photogrammetry15. Earthwork a. Cross Sections b. Calculations and Staking out of Cuts and Fills c. Earthwork Quantities16. Unites States Public Land Surveys a. Baselines and Meridians b. Townships, Ranges, and Sections c. Division of Sections17. Geographic Information Systems a. Raster and Vector Data Model b. Applications of GIS

General Education Outcomes:

6) Apply computational skills to a variety of contexts.
Students solve many homework problems, most of which require computation. Lab exercises also require computation. They also learn to use spreadsheets and other computational tools like CORPSCON to aid in their solution of surveying problems.

7) Apply scientific reasoning to a variety of contexts.
Much of this course is conceptually based even though there is a large computational component. Students learn to apply the concepts of surveying in almost daily homework and lab exercises. They also must present many problems in class and answer questions on them.

Key Performance Indicators:
Students will be assessed often through in-class quizzes and tests. Homework is assigned on a nearly daily basis to allow students to check their own progress.Homework assignments: 10%-20% of the final gradeQuizzes: 5%-15% of the final gradeTests: 40%-50% of the final grade (including comprehensive final)Laboratory exercises: 15%-25% of the final grade

Representative Text and/or Supplies:
Moffit AND Bossler; Surveying, Latest Edition; Addison Wesley.

Optimum Class Size: 12
Maximum Class Size: 12

Signatures:

I hereby submit this course syllabus:

Garth O. Sorenson, MS, Associate Professor

I hereby find this course consistent with the goals and resources of the Engineering and Computer Science Department:

Garth O. Sorenson, MS, Associate Professor, Chair

I hereby find this course consistent with the goals and resources of the Natural Science and Mathematics Division:

Dan Black, EdD, Associate Professor, Dean

I have discussed the need for library resources related to this class with the person submitting the syllabus:

Lynn Anderson, MLIS, Technical Services Librarian (Main Campus)

Michelle Olsen, MLS, Campus Librarian (Richfield Campus)