Application for Certification of a Course as a General Education Course

**CTE NATURAL SCIENCES CATEGORY**

Applicant: Guy Fo  
Course Alpha and Number: CMGT 211  
Course Title: Land Surveying for Construction

**Instructions:**

Explain how the learning taking place in this course (required course only) meets the hallmarks listed below for the Natural Sciences General Education Category. Do one or both of the following:

- Identify specific course SLOs that align with each hallmark.
- Describe class assignments or activities in which students learn and/or demonstrate the hallmark objective. Assignments and/or activities cited should be sufficiently important in terms of both time spent on them and their impact on students' final grades in the course.

Try to address all of the hallmarks. The strength of some responses should counterbalance the weakness of others. See hallmark questions that should be addressed in response to each of the hallmarks.

Also attach a copy of the official course outline.

**The Hallmarks:**

The course...

1. **enables students to identify and apply scientific language, concepts, assumptions, and processes.**
   
   See attached

2. **promotes knowledge of the use of scientific methods and reasoning in science.**
   
   See attached

3. **enables students to analyze and interpret scientific evidence.**
   
   See attached

4. **enables students to evaluate and apply scientific information to support interpretations and analyses.**
   
   See attached

Applicant's signature: [Signature]  
Date: 10/28/2013

*Please submit this application to your division secretary.*
1. **Hallmarks and SLOs.** Please explain how course-specific SLOs align with the diversification area’s hallmarks.

**Hallmark #1:** Enables students to identify and apply scientific language, concepts, assumptions, and processes.

*SLO 1: Explain the difference between plane surveying and geodetic surveying.*
- Students are required to understand how the curvature of the earth can affect surveying measurements. Therefore, the students must know the difference between plane surveying (where curvature effects are negligible) and geodetic surveying (where curvature of earth must be taken into account).

*SLO 2: Describe the different kinds of surveying.*
- Students must be able to describe the different levels of precision associated with the different kinds of surveying.

*SLO 3: Describe the different methods of measuring horizontal distances, and be able to choose the appropriate method for a given application.*
- Students must understand the distinction between random error (precision) and systematic error (accuracy). The students need to be able to describe the sources of both random error and systematic error associated with all of the measurements taken.
  - As an example, one method of measuring horizontal distances is taping. Systematic errors associated with taping include taking into account the tension in the tape along with the material properties of the tape material (such as the elastic modulus and cross-sectional area of the tape). Other systematic errors associated with taping include effects of the temperature and material properties of the tape such as the coefficient of thermal expansion. Other methods of measuring horizontal distances include the use of electronic distance meters utilize the speed of light and timing of light waves travelling to the target to indirectly measure the distance. The temperature and atmospheric pressure affect the speed of light and must be accounted for.

*SLO 4: Describe the different methods of determining elevations, and be able to choose the appropriate method for a given application.*
- Students must understand the distinction between random error (precision) and systematic error (accuracy). The students need to be able to describe the sources of both random error and systematic error associated with all of the measurements taken.
  - When determining elevations using direct leveling, students must understand how appropriate backsight and foresight distances reduce systematic errors associated with the curvature of the earth.

*SLO 9: Describe the basic principles of the Global Positioning System (GPS)*
- When using GPS to determine locations, students must be aware of the atmospheric effects on the light waves used by GPS systems. Students need to understand how differential GPS receivers can correct for the atmospheric effects.

**Hallmark #2:** Promotes knowledge of the use of scientific methods and reasoning in science.

*SLO 3: Describe the different methods of measuring horizontal distances, and be able to choose the appropriate method for a given application.*
- Students must understand how to correct for systematic errors in taping horizontal distances. To correct for systematic errors due to tape tension and field temperature, the tape must be properly calibrated. Students must take care to use proper
procedures to minimize random error and must take measurements so that the random error (proportional error) is within acceptable limits for the type of survey. When measuring horizontal distances with an electronic distance meter, students must use proper settings for the reflectivity of the target and must choose targets based on the required precision for the type of survey being performed. Reasoning must be used to minimize these random errors. For example, understanding that choosing to measure short segments or fully supporting the tape in windy areas helps to minimize both systematic and random errors.

**SLO 4: Describe the different methods of determining elevations, and be able to choose the appropriate method for a given application.**
- When performing direct leveling, students must keep backsight and foresight distances to minimize systematic errors due to instruments not being perfectly level as well as systematic errors associated with light refraction and the curvature of the earth. In addition, in areas where the terrain changes elevation rapidly, the students must keep the backsight and foresight distances short enough so that the target rods can be properly read.

**SLO 7: Perform topographic surveys and create views based on that data.**
- 7. When performing topographic surveys, students must use reasoning to make sure adequate target density is used around areas where the elevation changes more rapidly. This is important in estimating the amount of earthwork required for possible construction projects for the site being surveyed.

**SLO 8: Perform practical skills such as setting simple control points for a construction survey and laying out a curve for a roadway.**
- When setting control points for a construction site survey, a high level of precision and accuracy are required. When a control point's line of sight is blocked by an obstruction, students must use reasoning to determine the best way to use trigonometry to locate that control point. This typically involves the set up of right triangles and the use of double-centering techniques to locate points accurately. Laying out a roadway curve involves using trigonometry to calculate the location of the start of the curve, the end of the curve as well as the points in between the start and end.

**Hallmark #3:** enables students to analyze and interpret scientific evidence.

**SLO 3: Describe the different methods of measuring horizontal distances, and be able to choose the appropriate method for a given application.**
- When taping horizontal distances the, the systematic error is theoretically calculated with math equations for a given error. These include correcting for field temperature, for field tension, sag in the tape, and for grade when the tape is fully supported.

**SLO 5: Setup and use computer spreadsheets to perform calculations related to taping corrections, elevation adjustments and traverse adjustments.**
- Spreadsheets are used to facilitate these systematic error calculations. In addition, performing traverse adjustments involve a long series of computations that are calculated through the use of spreadsheet formulas.

**SLO 6: Describe and perform precise horizontal angle measurements.**
- When analyzing horizontal angle measurements, students must use techniques that minimize random errors when sighting targets as well as imperfections within the measuring devices built in horizontal circle. Students must also calculate the sum of the interior angles for a closed traverse and compare with the theoretical value determined by geometry.
SLO 7: Perform topographic surveys and create views based on that data.
- Prior to performing topographic surveys, students must analyze all important features of the terrain to allow adequate sighting of targets. Based on this analysis, students must choose targets that will give an accurate picture of the elevation contours so that earthwork costs can be properly calculated.

SLO 8: Perform practical skills such as setting simple control points for a construction survey and laying out a curve for a roadway.
- Prior to performing construction site surveys, students must analyze and choose appropriate points to set up as control points. This means understanding the high degree of precision for the measurements as well as designing the control points so that construction can be performed accurately.

Hallmark #4: enables students to evaluate and apply scientific information to support interpretations and analyses.
SLO 3: Describe the different methods of measuring horizontal distances, and be able to choose the appropriate method for a given application.
- When performing the taping of horizontal distances, the systematic error calculated with math equations for a given error is applied. These include correcting for field temperature, for field tension, sag in the tape, and for grade when the tape is fully supported. An analysis is made using the theoretical calculations and actual lab data. Further corrections are made and documented in lab reports.

SLO 6: Describe and perform precise horizontal angle measurements.
- When performing the horizontal angle measurements, students must use techniques that minimize random errors when sighting targets as well as imperfections within the measuring devices built in horizontal circle. Students use the theoretical values determined by their geometric analysis to calculate the sum of the interior angles. Further corrections are made and documented in lab reports.

SLO 7: Perform topographic surveys and create views based on that data.
- When performing topographic surveys, students apply analysis data to create an accurate picture of the elevation contours so that earthwork costs can be properly calculated. Final evaluations are made and documented in lab reports.

SLO 8: Perform practical skills such as setting simple control points for a construction survey and laying out a curve for a roadway.
- When performing construction site surveys, students apply analysis data to create a control point design with a high degree of precision for the measurements. This ensures construction is completed accurately. Final evaluations are made and documented in lab reports.

2. Assessment strategies. Formative and Summative assessments in the form of discussions, quizzes, written exams, lab reports and presentations will be utilized.
**PROPOSAL SUMMARY (Include reasons for adding course, and similar courses offered elsewhere, i.e. college, alpha, number, title):**

This course will be a replacement for CE 211 as a required course. Although CE 211 still exists in our course offerings UHM College of Engineering no longer offers, recognizes or has this course listed in their catalog; articulation with COE is no longer valid. Prior to CMGT's recent use of the course, CE 211 has not been offered since the Engineering Technology program existed. Because the course has not been utilized by any program other than CMGT, the existing course content no longer reflects the changes in technology and current best practices. The newly created course will realize these updates and also structure content toward students in our program.

After designation approval, this course will meet a CTE Gen Ed requirement needed toward an AS degree.
## CURRICULUM ACTION PROPOSAL

**ADD a New Course**

### INSTRUCTIONS:
Complete all applicable fields. Continue overflow text on p. 3 under “Additional Information”. Attach copies of all Catalog pages that are affected with changes marked.

<table>
<thead>
<tr>
<th>Course Alpha &amp; No.:</th>
<th>CMGT 211</th>
<th>Effective Term:</th>
<th>Fall 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Type:</td>
<td>Regular</td>
<td>Experimental Course Expiration Date:</td>
<td></td>
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<tr>
<td>Title:</td>
<td>Land Surveying for Construction</td>
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<td>Banner Title (30 characters):</td>
<td>Land Surveying for Constr</td>
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- **GEN ED**
  - YES
  - NO
  - Is this course certified to meet Career & Technical Education (AS/ AAS/ ATS) GEN ED Requirements?
    - If “YES”, select GEN ED below
      - I. Communications (ASCM)
      - II. Quantitative or Logical Reasoning (ASQL)
      - III. Humanities and Fine Arts (ASGD)
      - IV. Natural Sciences (ASGA)
      - V. Social Sciences (ASGC)
  - YES
  - NO
  - Is this course certified to meet Liberal Arts (AA) GEN ED Requirements &/or UHM GEN ED Core Articulation?
    - If “YES”, select GEN ED below.

### Course Data

| Class Length: | 16 weeks |
| Credits: (For Variable Credits give range) | 3 credits |
| Repeat & Credit Limit: | Students may enroll 0 time(s) for a maximum of 3 credit(s) |
| Schedule Type: | LAL (Lecture Lab) |
| Weekly Student Contact Hrs: | 2 Hours Lecture per Week, 3 Hours Lab per Week, 5 Total Contact hrs per Week |
| Details for special cases: |
| Grading Option: | Letter Grade Only |
| Enrollment Maximum: | 30 |
| Major Restriction: | Construction Management |
| Recommended Prep: |
| Special Approval: | Click To Select |
| Cross-Listed Courses: |
## University of Hawai‘i Honolulu Community College

### CURRICULUM ACTION PROPOSAL

#### ADD a New Course

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### COURSE DATA CONTENT

**Prerequisite:**

* (* State minimum grade if not a “D”)

**Prerequisite:** "C" or better in MATH 103

**Co-requisite:**

**Catalog Course Description:**

This course is a basic course on land surveying. It provides the basic skills of plane surveying, using instruments for distance measurements, angular measurements, and determining elevations. The course provides experience with completing closed traverses and topographic surveying. Computer spreadsheets are utilized to facilitate common calculations associated with plane surveying.

**Additional Information to print with Catalog Course Description:**

**Class Availability Comment (Web viewable):**

**Course SLOs:** (Attach Course Outline Form)

**Course Outline:** (Attach Course Outline Form)

### IMPACT

☑ **YES** ☐ **NO** Are any PROGRAMS impacted by this proposal? *(i.e. Program Credits, Courses, Prerequisites, Requirements, Electives, etc.)*

If “Yes” attach Program Modification Form(s) and briefly explain below.

☑ **YES** ☐ **NO** Are any COURSES impacted by this proposal? *(i.e. Course Prerequisites, Co-requisites, Recommended Prep, Cross-Lists, etc.)*

If “Yes” attach Course Modification Form(s) and briefly explain below.

☑ **YES** ☐ **NO** Were the affected Programs/Departments consulted and notified of the proposed changes?

**Describe impact on Programs and/or Courses (Attach appropriate Program Modification and Course Modification Forms.)**

Since CMGT faculty are the only instructors offering CE 211 at this time, no further notification outside the department was needed.

☐ **YES** ☑ **NO** Does this proposal require additional resources? *(i.e. staff, equipment, facilities, etc.)* If yes, provide details below.

**Additional Information:**
Course Title: Land Surveying for Construction

Prerequisite: "C" or better in MATH 103

Catalog Course Description:
This course is a basic course on land surveying. It provides the basic skills of plane surveying, using instruments for distance measurements, angular measurements, and determining elevations. The course provides experience with completing closed traverses and topographic surveying. Computer spreadsheets are utilized to facilitate common calculations associated with plane surveying.

Student Learning Outcomes:
Upon successful completion of this course, a student will be able to:
1. Explain the difference between plane surveying and geodetic surveying.
2. Describe different kinds of surveying.
3. Describe different methods of measuring horizontal distances, and be able to choose the appropriate method for a given application.
4. Describe different methods of determining elevations, and be able to choose the appropriate method for a given application.
5. Setup and use computer spreadsheets to perform calculations related to taping corrections, elevation adjustments, and traverse adjustments.
6. Describe and perform precise horizontal angle measurements.
7. Perform topographic surveys and create views based on that data.
8. Perform practical skills such as setting simple control points for a construction survey and laying out a curve for a roadway.
9. Describe the basic principles of the Global Positioning System (GPS)

Means by which the assessment of the SLOs will be accomplished:
Students will be evaluated based on their performance on quizzes, written reflections, examinations and a culminating project.

Program Learning Outcomes addressed by this course:
2. Explain the materials and methods used in the construction of commercial and residential construction projects, covering procedures, equipment, sustainability and techniques.

Method(s) of Instruction:
Lecture / Lab

Method(s) of Evaluation:
Students will be evaluated based on their performance on quizzes, written lab reports, and a summative written and hands-on assessment.
7. **Course Content:**
   1. Surveying Fundamentals
   2. Leveling
   3. Distance Measuring
   4. Introduction to Total Stations and Theodolites
   5. Total Station Operations
   6. Traverse Surveys and Computations
   7. Satellite Positioning
   8. Introduction to Geomatics
   9. Horizontal Control Surveys
   10. Machine and Guidance Controls
   11. Highway Curves
   12. Highway Construction Surveys
   13. Pipeline and Tunnel Construction Surveys
   14. Culvert and Bridge Construction Surveys
   15. Building Construction Surveys
   16. Quantity and Final Surveys

8. **Possible Texts:**
   Surveying with Construction Applications 7th Edition

9. **Reference and/or Auxiliary Materials (if any):**

10. **Resource Requirements (if applicable):**

11. **Relationship to other courses in the program (if applicable):**
    This course provides the foundation for future courses in a sequence towards a degree or certificate.

12. **General Education or other requirement(s) satisfied:**
    Natural Science

13. **Articulation (if applicable):**

14. **Additional information of importance:**
    Student Learning Outcome's (SLO's) are in alignment with the American Council for Construction Education (ACCE) Topical Content requirements