COURSE OUTLINE
CONS 203 – ADVANCED SURVEYING

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Revised by J Reilly 2014

CANINO SCHOOL OF ENGINEERING TECHNOLOGY
DEPARTMENT OF CIVIL AND CONSTRUCTION TECHNOLOGY
APRIL 2014
CONS 203 – ADVANCED SURVEYING

A. **TITLE:** Advanced Surveying

B. **COURSE NUMBER:** CONS 203

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE (OPTIONAL):** N/A

E. **COURSE LENGTH:** 15 Weeks

F. **SEMESTER(S) OFFERED:** Fall

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
   - Lecture: 1 – 50 minute lecture
   - Laboratory: 1 – 1 hr 50 min recitation/computer lab
   - 1 – 2 hr 50 minute laboratory (field work)

H. **CATALOG DESCRIPTION:** This course emphasizes fundamentals of field and office procedures used in the construction industry. Major topics covered are: mapping procedures, topographic survey methods, area determinations by coordinates, determination of volumes for earthworks, horizontal and vertical control necessary for mapping and building layout, horizontal (circular) curves and vertical (parabolic) curves. The student uses modern surveying equipment in field sessions, including total stations, automatic levels and lasers, geographic positioning satellite receivers and integrated mapping and surveying software for data analysis and map compilation.

I. **PRE-REQUISITES:** Elementary Surveying (CONS 101).

J. **GOALS (STUDENT LEARNING OUTCOMES):** By the end of this course, the student will be able to:

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<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
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<tr>
<td>a. Interpret the meaning of contour lines and generate contour lines based on elevation data using interpolation.</td>
<td>3. Professional Competence</td>
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<td>b. Demonstrate proficiency in the use of surveying software package such as “Wolfpack” and spreadsheet routines to improve the efficiency (speed, number and accuracy) of making surveying calculations.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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<td>c. Measure and record angles and distances between points using total station equipment and use these data to compute the coordinates of control points.</td>
<td>3. Professional Competence</td>
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<td>d. Collect the field data needed to prepare a topographic map by the radiation method using total station equipment.</td>
<td>3. Professional Competence</td>
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<tr>
<td>e. Analyze total station topographic map data using CAD software designed for map preparation and use the analyzed data.</td>
<td>2. Critical Thinking 3. Professional Competence</td>
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to draw a final map.

| f. Calculate staking notes needed to construct a road with horizontal and vertical curves and use the total station and a surveyor’s tape to set points for highway centerlines in the field. | 3. Professional Competence |
| g. Determine earthwork quantities for highway construction and/or a borrow pit. | 3. Professional Competence |
| h. Demonstrate both team and leadership skills. | 4. Inter/Intra personal skills |


L. **REFERENCES:** *AutoCad Civil 3D for surveyors*, Schroff Development Corporation

M. **EQUIPMENT:** Automatic Level, Total Station, Prism Poles, Geographic Positioning System Receivers, Drafting Software, Metal Detector, Steel Tape, Range Pole, Engineering Rod (Leveling), Miscellaneous Hand Equipment are provided by the department.

The student is expected to provide the following:

- A calculator capable of performing addition, subtraction, multiplication, division, trigonometric functions, inverses, exponentiation and roots.
- Quadrille ruled Engineering Computation paper for assignments.
- A Student Field Book.
- A sharp pencil(s) with H or HB lead for computations.
- A sharp pencil(s) with 3H or 4H lead for field notes.
- A 256 MB (or larger) Flash Memory Drive.
- The following drafting equipment:
  - 6 inch C-Thru W-37 Plastic Ruler with Protractor with 10 and 50 scales
  - Drafting set for Civil Engineering Technology

N. **GRADING METHOD:** (P/F, A-F, etc.) A-F

O. **MEASUREMENT CRITERIA/METHODS:**

Student learning in this course will be assessed by a number of homeworks, quizzes, exams (3 hourlies and a final), lab projects, a topographic map and a dexterity test. The grading of each of these assessments will be based on the following four factors:

1. Evidence of student understanding of the topic assessed
2. Evidence of student thinking
3. Communication of problem solution
4. Demonstration that the student cares about the quality of the work
P. DETAILED TOPICAL OUTLINE:

I. Introduction/Review Differential Leveling
   A. Review Leveling
   B. Techniques of Leveling
   C. Peg Test
   D. Level Loop Adjustments

II. Review Angles and Direction
   A. Total Stations
   B. Azimuths
   C. Bearings

III. Coordinate Geometry
   A. Review
   B. Determination of Intersections
   C. Resection

IV. Map Projections and Coordinate Systems
   A. Need for Map Projections
   B. Coordinate Systems
   C. State Plane Coordinates

V. Geographic Positioning System
   A. Introduction to system components
   B. How satellite signals determine positions
   C. Sources of error
   D. Static survey procedure
   E. Kinematic survey procedure

VI. Topographical Surveying
   A. General Setup of Survey
   B. Radiation survey procedure
   C. Map Drafting with Land Desktop
   D. Survey Drafting
   E. Contours

VII. Construction Control Surveys
   A. General Use and Responsibilities
   B. Position Accuracies
   C. Specifications for Short Lines
   D. Coordinate Grid Systems
   E. Coordinate Geometry (COGO)
   F. Project Control

VIII. Highway Curves
   A. Route Surveys
   B. Circular Curves
      1. Chord Calculations
      2. Offset Curves
      3. Compound Curves
C. Vertical Curves
   1. Geometric Properties of the Parabola
   2. Computations of Vertical Curves
D. Design Considerations

Q. **LABORATORY OUTLINE:**

   Field Laboratory Project / Drafting Laboratory Project

1. Peg Test of a Level
2. Map Project Traverse Elevation Survey
3. Map Traverse Planimetric Survey
4. Location of Map Traverse Point with GPS
5. Topographic Map Side Shots / Topographic Map Drafting
6. Topographic Map Side Shots / Topographic Map Drafting
7. Topographic Map Side Shots
8. Horizontal Curves
9. Transfer of data from CAD plans to a total station
10. Trigonometric Leveling of Borrow Pit Elevations
11. Field Check of Topographic Map
12. Total Station Dexterity Test
13. Finalization of Topographic Map
14. Use of GPS
15. Structure Layout