COURSE OUTLINE
AREA 320 – EXPERIMENTATION & MEASUREMENT I

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Canino School of Engineering Technology
Mechanical & Energy Technology
May 2015
A. **TITLE:** Experimentation & Measurement I

B. **COURSE NUMBER:** AREA 320

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 weeks

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

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:** (3) 2-hour laboratories per week

H. **CATALOGUE DESCRIPTION:** In this laboratory students will learn experimental methods, instrumentation for engineering measurements, statistical estimates of experimental uncertainty, and calibration techniques. Students will perform laboratory experiments that are applicable to energy systems as well as to broader engineering applications. This course serves as the foundation for higher level lab and design courses in this curriculum.

I. **PRE-REQUISITES/CO-COURSES:**

   a) Pre-requisites: MECH 241, Fluid Mechanics, ENGS 102, Programming for Engineers, MATH 141, Statistics,

J. **STUDENT LEARNING OUTCOMES:**

By the end of this course students will be able to:

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
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<tr>
<td>a. Apply basic experimental methodology, including statistics, error analysis, and uncertainty propagation.</td>
<td>2. Crit. Thinking 3. Prof. Competence</td>
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<td>b. Describe the principles used to make common physical measurements.</td>
<td>2. Crit. Thinking 3. Prof. Competence</td>
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<td>d. Write technical reports to convey results of lab experiments.</td>
<td>1. Communication 2. Crit. Thinking 3. Prof. Competence</td>
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K. **TEXTS:**

L. **REFERENCES:**


M. **EQUIPMENT:** Wind Turbine, Solar panels, geothermal model, fuel cell, bio-fuel processor

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

O. **MEASUREMENT CRITERIA:** Grading may include lab notebook, lab reports, homework, quizzes, and exams.

P. **DETAILED TOPICAL OUTLINE:** N/A

Q. **LABORATORY OUTLINE:**

1. Basic Measurement Concepts
   a. Statistical review
   b. Statistical analysis of experimental data

2. Measurements Uncertainty
   a. Precision, bias, and total uncertainty
   b. Error propagation

3. Linear regression methods and statistics
   a. Graphical data presentation
   b. Time constant and dynamic response
   c. Calibration techniques

4. Electrical measurements
   a. Voltage, current, power
   b. Using an oscilloscope

5. Temperature measurement
   a. Thermometers
   b. Thermocouples
   c. Resistance thermometers (RTD’s and thermistors)
   d. Pyrometers

6. Humidity measurement
   a. Psychrometrics
   b. Humidity transducers

7. Flow measurement
a. Obstruction flow meters
b. Variable-area flow meters
c. Thermal anemometers
d. Flow visualization

8. Pressure measurement
   a. Static, dynamic, and total pressure
   b. Pressure transducers

9. Computer-aided data acquisition
   a. Analog-to-digital conversion
   b. Sampling rate and aliasing
   c. Range and resolution