STATE UNIVERSITY OF NEW YORK !
COLLEGE OF TECHNOLOGY !
CANTON, NEW YORK !

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
AREA 370 - EXPERIMENTATION & MEASUREMENT II

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Canino School of Engineering Technology !

Department: Mechanical & Energy Technology !

Semester/Year: Fall/2018 !

A. **TITLE**: Experimentation & Measurement II

B. **COURSE NUMBER:** AREA 370

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 3
 # Lecture Hours: **per week**
 # Lab Hours: (3) 2-hours **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☒ No ☐

E. **GER CATEGORY: None:** ☒ **Yes:** GER !
***If course satisfies more than one*:** GER !

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☒ **Fall & Spring** ☐

G. **COURSE DESCRIPTION:**

In this laboratory course students will perform engineering measurements to acceptable standards. They will also choose the method of measurement to achieve the accuracy necessary for use in alternative energy experiments. A hands-on approach will furnish practical knowledge of the operation of various alternative energy devices and diagnostic tools. The labs will reflect topics discussed in the AREA electives.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

AREA 320, Experimentation & Measurement I

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
Apply knowledge of measurement principles.	SO #1 An appropriate mastery of the knowledge, techniques, and skills, and modern tools of their disciplines utilizing renewable energy systems and design parameters		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	CA Subsets Subsets Subsets
Use measurement equipment to characterize the performance of energy systems.	SO #3 An ability to conduct, analyze and interpret experiments, and apply experimental results to improve processes.		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	CA Subsets Subsets Subsets
Perform experiments on sustainable energy systems.	SO #5 An ability to function effectively on teams.		2-Crit Think 5-Ind, Prof, Disc, Know Skills 4-Soc Respons	CA Subsets T Subsets
Analyze and interpret experimental results.	SO #3 An ability to conduct, analyze and interpret experiments, and apply experimental results to improve processes.		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	CA Subsets Subsets Subsets
Write technical reports to discuss experiments and results.	SO # 7 An ability to communicate effectively through written, oral, and graphic methods related to renewable energy systems.		1-Comm Skills 5-Ind, Prof, Disc, Know Skills ISLO	W Subsets Subsets Subsets

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

*Include program objectives if applicable. Please consult with Program Coordinator !

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

If YES, select one or more of the following categories:

- ☒ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☐ Entrepreneurship (program, class, project)

K. TEXTS:

Holman, J.P., Experimental Methods for Engineers, 7th edition, McGraw Hill, 2001

L. REFERENCES:

Beckwith, T.G., Marangoni, R.D., and Lienhard V, J.H., Mechanical Measurements (5th edition), Addison-Wesley, 1993 !
Figliola, R.S. and Beasley, D.E., Theory and Design for Mechanical Measurements (3rd edition), John Wiley & Sons, 2000
2003 ASHRAE Handbook, HVAC Applications, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
Dickson, Mary and Fanelli, Mario; Geothermal Energy: Utilization And Technology, 2005, Earthscan Publications !
Duffie, J. A. and Beckman, W. A., Solar Engineering of Thermal Processes , 2nd edition, 1991, John Wiley & Sons, Inc.
Larminie, James and Dicks, Andrew; Fuel Cell Systems Explained, 2nd Edition, 2003, John Wiley and Sons !
Manwell, J. F., McGowan, J. G., and Rogers, A. L. Wind Energy Explained, 2002, John Wiley and Sons !
United States Department of Energy, 21st Century Complete Guide to Biofuels and Bioenergy: ! Department of Energy Alternative Fuel Research, Agriculture Department Biofuel Research, Biomass, Biopower, Biodiesel, Ethanol, Methanol, Plant Material Products, Landfill Methane, Crop Residues (CD-ROM !

M. EQUIPMENT: None ☐ **Needed:** Wind turbine, solar panels, geothermal model, fuel cell, biofuel processor. Associated instrumentation including anemometer, pyranometers, pyrheliometer, digital multimeters, watt meters, oscilloscopes, temperature and pressure sensors, flow meters, titration, pH, mass, volume, and etc.

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Grading may include lab notebook, lab reports, homework, quizzes, and exams.

P. DETAILED COURSE OUTLINE:

N/A

Q. LABORATORY OUTLINE: None ☐ Yes ☒

1. Wind Turbine Module
- **a. Drag force measurement**
- **b. Air velocity measurement**
- **c. Collect and analyze wind data**
- **d. Power curves of wind turbines**
- **e. Efficiency of AC to DC conversion**

2. Solar Thermal Energy Module
- **a .Measure & record beam and diffuse solar insolation on flat and tilted panels**
- **b. Flat-plate collectors**
- **c. Effects of glazing**
- **d. Thermal energy storage**

3. Solar Photovoltaic Energy Module
- **a. Perform basic electrical measurements on various PV cells**
- **b. Module and array design**
- **c. I-V and P-V curves**
- **d. Peak power point tracking**

4. Geothermal Module
- **a. Efficiency of heat exchangers**
- **b. Pump sizing**
- **c. Effects of ground loop systems**
- **d. Earth temperature gradient**

5. Fuel Cell Module
- **a. Handling of Hydrogen**
- **b. Set up of cell for power generation**
- **c. Different fuel sources**
- **d. Cell Contamination and cleaning**

6. Biofuel Module
- **a. Biodiesel from vegetable oil**
- **b. Oil extracted from wood chips**
- **c. Heat values of various biofuels**
- **d. Measuring moisture content of various biofuels**
- **e. Methane extraction from landfills (field trip)**

7. Electrical Energy Storage
- **a. Battery types**
- **b. Battery characteristics**
- **c. Battery management**