AC 2010-957: BRINGING OUT THE BEST FROM THE ENGINEERING TECHNOLOGY STUDENTS THROUGH A SENIOR PROJECT COURSE

Stephen Frempong, State University of New York

Bringing out the best from Engineering Technology students through a capstone (project) course at SUNY Canton

Abstract:

The capstone (project) course in the Electrical Engineering Technology program was developed four years ago at the State University of New York at Canton is making a big difference in our senior students. This paper will discuss a more hands-on senior capstone course that gives the student an opportunity to think, research, design, construct, and present a finished product based on two year academic experience and knowledge from courses such as: Industrial Electronics, Industrial Controls, Energy Conversion, Microprocessors, Electronic Circuits, AC/DC Circuits and General Education Courses. This paper will discuss how the course is run (syllabus), sample projects, student survey, and the Electrical Engineering Technology program at SUNY Canton.

The State University of New York at Canton

The State University of New York at Canton is a public, coeducational, residential college located on a spacious campus along the banks of the Grasse River. Its northern location places SUNY Canton close to the Adirondack Mountains, the St. Lawrence River, and major Canadian cities such as Ottawa and Montreal.

Course Syllabus (1 Credit)

Engineering Technology Project (ELEC203): This is a senior project (capstone) course that gives the student an opportunity to think, design, construct, and present a finished product based on knowledge/experience from previous or current courses such as electronic circuits, telecommunications, microprocessors, industrial controls, and electrical energy conversion. Each team is expected to do classroom presentation/demonstration on the final project. Examples of design project: Emergency Power Supply, Home Security System (using sensing devices), Robotics, Radio Transmitter, Remote Control for Industrial Motors, and Electrically Testing Human Reaction Time. All project proposals

must be approved by course instructor. A minimum of three laboratory hours per week is required. Prerequisites: Electrical Energy Conversion, Industrial Controls, Electronic Circuits, or permission of instructor.

Goals (student learning outcomes)

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

1. Perform basic research
2. Play a role in a team project
3. Apply critical thinking in practical design project
4. Conform to public speaking standard established for this course
5. Submit a proposal that meets specific standard
6. Provide project updates
7. Prepare documentation for the project
8. Play a role in the classroom presentation
9. Demonstrate the operation of the finished product
10. Respond effectively to questions during presentation

Project Should Meet the Following Standards:

- Project should lead to a finished system or product.
- Project should involve electrical, electronics, computer programming or electromechanical technology application.
- All robotic projects must involve computer programming.
- All projects must have a certain level of difficulty.
- Every project must be approved by course instructor.

Detailed Course Procedure

1. Team formation

Students form teams during the first day of class. The limit is three students per team. However, in some special cases four students are allowed to be in a team. Students share email addresses, phone numbers, and responsibilities.

2. Project proposal

Each team must decide on a specific project and submit one page proposal for approval.

3. Project approved or disapproved

The instructor decides on project difficulty and standards, and approved or disapproved the proposal.

If proposal is disapproved, the team is given two weeks to resubmit.

4. Project research/design

Students research details of the project (technical information), and project design using available software such as: PSpice, Circuitmaker, Microsoft Visio, and etc.

5. Obtain materials/components needed

Each team is responsible for purchasing components needed for their project. However, students are welcome to use available components and devices in laboratory. In some cases, the department had purchased some of the needed components for students. This will depend on the size and cost of the project, and also department budget. Faculty tries to encourage each team to select a project within their budget.

6. Updates/questions and answers

Each team gives an update on their project every two weeks in classroom, and instructor provides input to questions that each team might have. Students are encouraged to suggest answers to problems that others might be having.

7. Weekly construction and testing

Students continue with weekly project construction and testing. During the construction and testing, students are free to work in any one of the three laboratories (Electrical, Industrial Control, or Electronics lab). Faculty and laboratory technician are available during this process to provide technical advice. Construction and testing must be completed one hour before the presentation and demonstration.

8. Final paper submission

Each team submits a final paper about the project with fifteen pages minimum. This final project paper should provide detail information on the cost, materials/components involved, test procedure and results, and diagrams. Final paper must be submitted to faculty before the presentation and demonstration.

9. Class presentation

Each team is given twenty minutes to do PowerPoint presentation about their project, and five minutes for questions and answers. Each member of the team is evaluated independently during the presentation. Email is sent out to the campus community to invite students, faculty and staff to the project presentation and demonstration. Course faculty is the only evaluator during this project presentation and demonstration.

10. Project demonstration

Each team is given 10 minutes to demonstrate how their system or project works. Robotic table is available for all robotic demonstrations. Students are free to take their project home, or leave it in the laboratory for display.

Methodology

Students are evaluated based on the following: project proposal, project research and design, project updates, final paper, classroom presentation and demonstration.

Grading Policy

Project Proposal	10%
Project Research &Design	10%
Updates (Every 2-Weeks)	10%
Final Project Paper	20%
Project Presentation /Q&A	30%
Project Demonstration	20%
Total	100%

Partial list of projects successfully executed by students during the past three years:

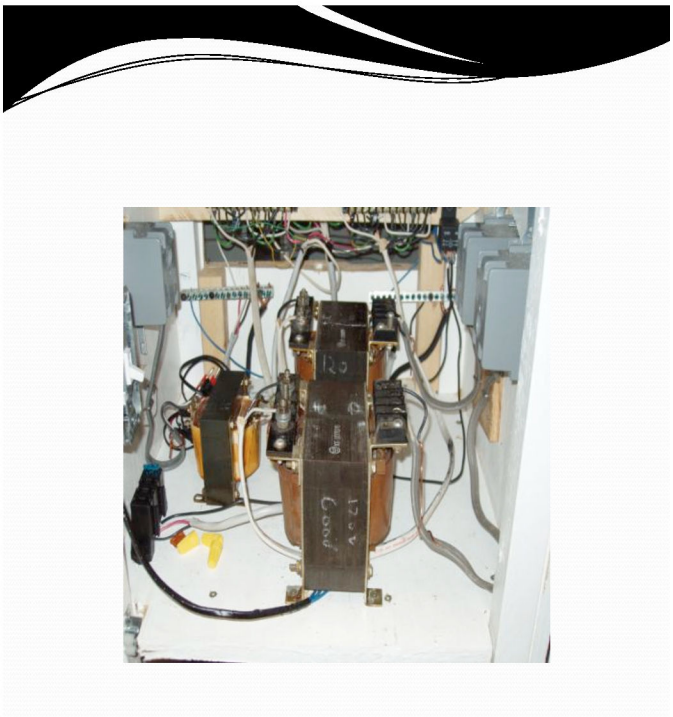
- Programmable Robot – Spring 2009
- Electrically Testing Human Reaction Time – Spring 2008
- Talking Parking Meter – Spring 2008
- Standby Power Supply – Spring 2008

- Automatic Intruder Alarm – Spring 2008
- Industrial Motors Remote Control – Spring 2007
- Radio Transmitter Using Tubs – Spring 2007

Project Pictures

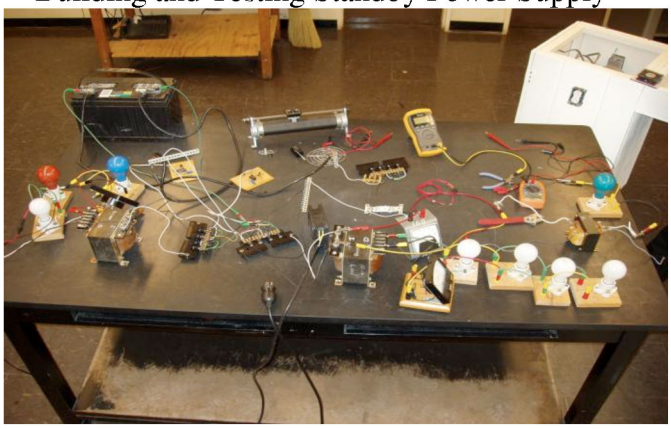
Senior Project 2008

Transformers used in this project



Senior Project 2008

Building and Testing Standby Power Supply



Students at Work (Standby Power Supply - 2008)

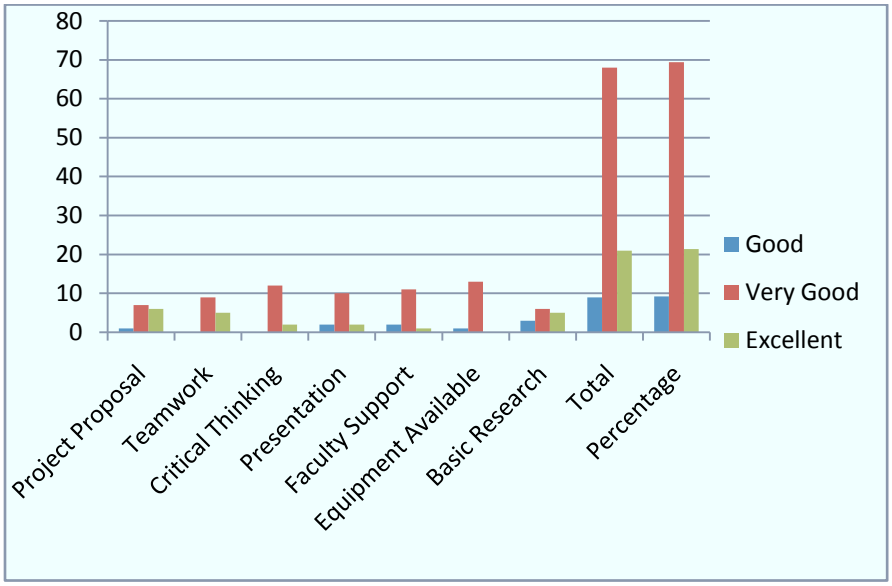
Students Survey

In a simple survey, students were asked to show their satisfactory level based on the questions indicated in the tables below.

EET – Spring 2007 Senior Project

Number of students = 14	EET-Program (Spring 2007)			
Skills Gained/Satisfactory	None	Good	Very Good	Excellent
Project Proposal		1	7	6
Teamwork		0	9	5
Critical Thinking		0	12	2
Presentation		2	10	2
Faculty Support		2	11	1
Equipment Available		1	13	0
Basic Research		3	6	5
Total		9	68	21
Percentage		**9.2%**	**69.4%**	**21.4%**

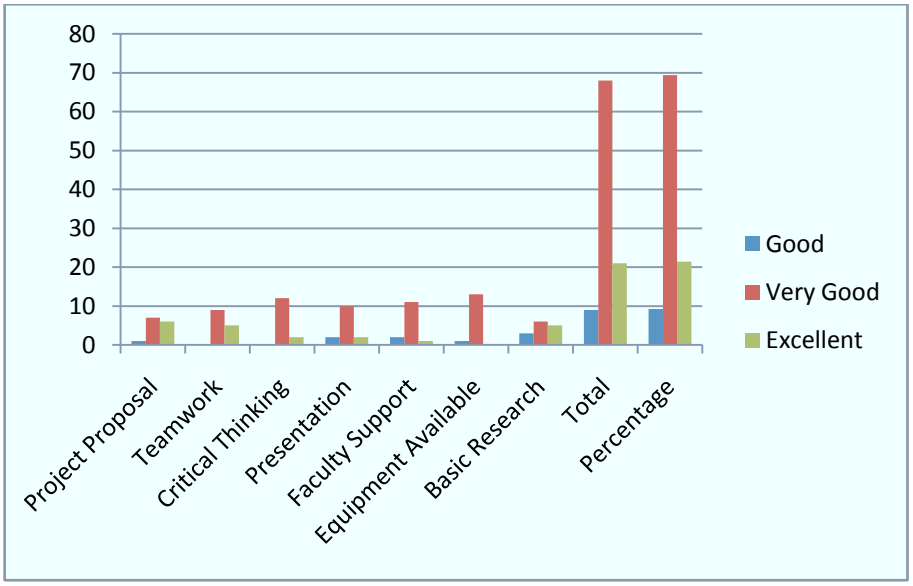
EET- Spring 2007 Senior Project Evaluation



EET – Spring 2008 Senior Project

Number of student = 11	EET-Program (Spring 2008)			
Skills Gained /Satisfactory	None	Good	Very Good	Excellent
Project Proposal		2	5	4
Teamwork		0	4	7
Critical Thinking		0	7	4
Presentation		1	8	2
Faculty Support		0	7	4
Equipment Available		3	8	0
Basic Research		0	4	7
Total		6	41	30
Percentage		7.8%	55.8%	36.4%

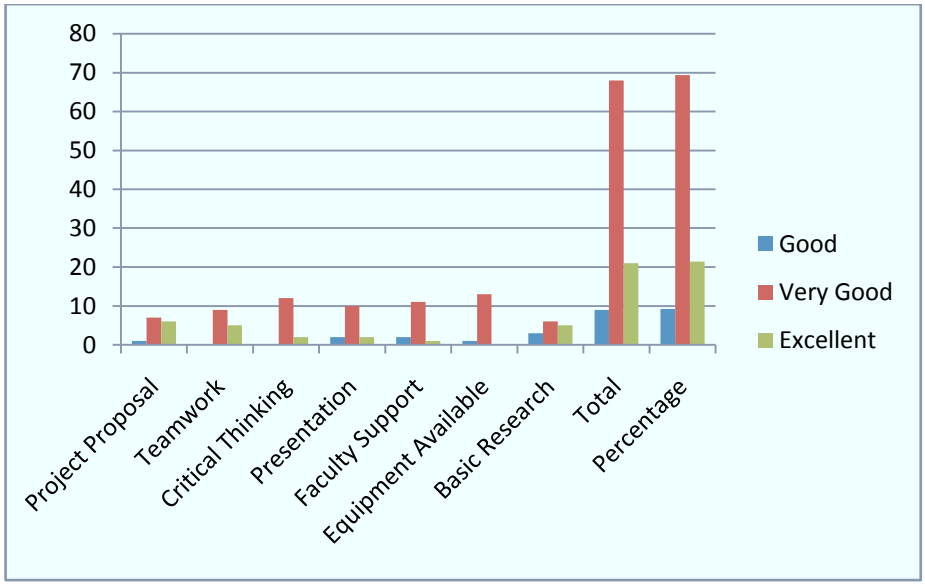
EET-Spring 2008 Senior Project Evaluation



EET- Spring 2009 Senior Project

Number of students = 12	EET – Program (Spring 2009)			
Skill Gained/Satisfactory	None	Good	Very Good	Excellent
Project Proposal		2	6	4
Teamwork		1	3	8
Critical Thinking		0	3	9
Presentation		1	6	5
Faculty Support		2	4	6
Equipment Available		2	6	4
Basic Research		0	3	9
Total		8	31	45
Percentage		9.5%	36.9%	53.6%

EET –Spring 2009 Senior Project Evaluation



In 2009, we had four senior project groups with three students per group. The interesting part of this senior year project is that, they all decided to embark on programmable robotic projects. This made it easier to evaluate all the teams on a common standard.

Senior Robotic Project 2009

Senior Robotic Project 2009

Senior Robotic Project 2009

Senior Project 2007
Radio Transmitter Station

Expected Course Improvement:

Students have indicated that there is no match between the credit hours for the course, and the amount of work and time involved. Students feel that the senior project course should be three credits to justify the amount of work required. The Electrical Engineering Technology faculty members are discussing the possibility of making it a three credit course. Another improvement expected is to select three or four faculty members to serve as judges during

the presentation and project demonstration to include more people in the final decision process. A new four year degree program in EET is expected to start in the fall 2010. This will provide more flexibility and opportunities for students to have a second senior project course where they will be able to build from the experience gained from this one credit course.

Conclusion

The senior Engineering Technology project developed four years ago at SUNY Canton is bringing the best out of our graduates. This course has provided an opportunity for a student to be creative and apply skills and experiences learned from courses both technical and nontechnical, and apply to a specific technical hands-on project. Teamwork, share of responsibilities, presentation of the final project and demonstration, questions/answers from faculty, staff, and students have helped prepare our graduates for the job market.

ELECTRICAL ENGINEERING TECHNOLOGY PROGRAM
State University of New York at Canton

First Semester

Courses	Credit
ELEC 101 Electric Circuits 1	3
ELEC 109 Electric Circuits 1 Laboratory	1
ELEC 111 Digital Circuits	2
ELEC 161 Electronic Fabrication	2
ENGL 102 Oral & Written Expression	3
MATH 123 Pre -Calculus Algebra	4
ENGS Programming for Engineers	1
	16

Second Semester

ELEC 102 Electric Circuits 2	3
ELEC 129 Electric Circuits 2 Laboratory	1

ELEC 141 Industrial Controls	2
ELEC 212 Digital Systems	2
ELEC 219 Digital Systems Laboratory	1
ENGL ___English (Literature)	3
MATH 161 Calculus 1	4
	16

Third Semester

ELEC 231 Electronic Circuits	4
ELEC 201 Electrical Drafting	2
ELEC 213 Microprocessors	3
ELEC 215 Electrical Energy Conversion	4
PHYS 121 College Physics I (GER 2)	3
PHYS 125 Physics Lab I	1
	17

Fourth Semester

ELEC 203 Engineering Technology Project	1
ELEC 225 Telecommunications	3
ELEC 232 Industrial Electronics	4
ELEC 243 Automated Control Systems	2
PHYS 122 College Physics II	3
PHYS 126 Physics Lab II	1
____ Social Science Elective	3
	17

Graduation Requirements: 66 Semester Credit Hours with a G.P.A. of 2.0 minimum