

**ELECTRONIC TECHNOLOGY –
ELECTRONIC TECHNOLOGY WITH
COMPUTER SYSTEMS OPTION**

FALL 2008

OBJECTIVES ASSESSED:

- Obj. 1: The ability to use a schematic diagram to build and test electrical/electronic circuits and systems.
- Obj. 2: The ability to identify, formulate, and solve technical problems.
- Obj. 3: The ability to create and conduct technical experiments and analyze and interpret data.
- Obj. 6: Critical thinking competencies – The ability to evaluate, compare, analyze, critique, and synthesize information.
- Obj. 7: Writing competencies – the ability to produce clear and well-organized writing which responds appropriately to an assignment using standard American English.

SUMMARY REPORT

September 29, 2009

OUTCOMES ASSESSMENT SUMMARY REPORT: FALL 2008

Electronic Technology and Electronic Technology: with Computer Systems Option programs

Summary:

Design projects were implemented in both the Electronic Technology and Electronic Technology: with Computer Systems Option programs. These design projects are both a valuable lesson for students and a method to assess program outcomes. Both the design course and outcomes support both programs, ET & ET with Computer Systems Option. The Binary Coded Decimal (BCD) Invalid Code Detector was developed by CTE faculty Mike Pelletier, Lori Heymans and Paul Chanley and implemented in Digital Design Lab, (CTE103). This course is taken first semester freshman year. A detailed rubric was developed to evaluate student performance. The rubric also aligns design project criteria with program outcomes.

The following summary is based on Design projects submitted in the fall of 2008 by 33 students. The numbers in bold indicate program outcomes.

1) The ability to use a schematic diagram to build and test electrical/electronic circuits and systems.

1.1) The graduating student will be able to demonstrate knowledge and hands on competence in the analysis of digital and analog electronics by the prototyping, testing, troubleshooting and operating of electrical/electronic circuits and systems.

The above program outcome was assessed during steps 5 & 7 of the design project, using the following criteria:

- Construct the NAND gate only circuit and test the operation of the circuit by filling in a truth table with the results.
- Construct the Multiplexer/Data Selector circuit and test the operation of the circuit by filling in a truth table with the results.

The students did well on this task with over 90% scoring in the "Accomplished" or "Exemplary" scale of the rubric on each of the criteria.

2) The ability to identify, formulate, and solve technical problems.

2.1) Analyze problems, that is, isolate and describe the important components of a problem: what is given (design specifications, performance requirements, testing standards, etc.); what is known from previous experience relevant to the problem; and what the unknowns are.

2.2) Represent the problem in a visual form such as a schematic, flow chart, diagram, or data table. This visualization will represent the components of the problem in a way that leads to the construction of a solution.

2.3) Demonstrate the ability to conduct an experimental procedure, use laboratory materials properly and safely, carefully note observations in a laboratory notebook, and describe the procedure clearly for others.

The above program outcomes were assessed during steps 1 through 7 of the design project. Students did well on the following tasks with 90 % scoring in the "Accomplished" or "Exemplary" scale of the rubric for each of the following criteria:

- Complete the truth table. Generate a Boolean expression from the truth table.
- Construct the NAND gate only circuit and test the operation of the circuit by filling in a truth table with the results.
- Construct the Multiplexer/Data Selector circuit and test the operation of the circuit by filling in a truth table with the results.

The data indicated that students did not do as well in steps 2 and step 6 of the design project with 82% of the students scoring "Accomplished" or "Exemplary" on each of the criteria used. These two steps asked the students to draw logic circuits for the simplified Boolean expression and Multiplexer circuit. Further analysis of the data showed two students received an "unacceptable" score for these tasks. The students probably failed to submit drawings. The data indicated that the majority of the students did well on this task with at least 20 students scoring "Exemplary" on each of the two criteria.

3) The ability to create and conduct technical experiments and analyze and interpret data.

3.4) Analyze and interpret the data.

The above program outcome was assessed during steps 5 & 7 of the design project, (Construct the NAND gate only circuit and test the operation of the circuit by filling in a truth table with the results. Construct the Multiplexer/Data Selector circuit and test the operation of the circuit by filling in a truth table with the results). The students did well on this task with over 90% scoring in the "Accomplished" or "Exemplary" scale of the rubric.

6) Critical Thinking Competencies - The ability to evaluate, compare, analyze, critique, and synthesize information.

6.3) Develop a hypothesis or thesis by applying logical, scientific and/or quantitative reasoning.

6.4) Apply logical, critical, and creative thought process to identify problems, make decisions, and develop solutions.

The above program outcomes were assessed during steps 1, 2 and 6 of the design project. The detailed explanation for the three steps has already been provided in this document.

7) Writing Competencies -The ability to produce clear and well-organized writing which responds appropriately to an assignment using standard American English.

7.1) Produce clear and well organized writing that responds appropriately to course assignment.

The above program outcome was assessed in step 8 of the design project (Criteria: Submit a report with the title BCD Invalid Code Detector, your name, the date, a paragraph describing what the BCD Invalid Code Detector does, and the neatly drawn items from steps 1 through 8 which support your design).

Only 70 % of the students scored "Accomplished" or "Exemplary" in this section of the design project. Remember, the design project is implemented first semester freshmen year. Students have not been exposed to the courses at NECC that would help them improve their writing competencies.

Note: Preliminary analysis of design projects submitted from summer 2009 indicate that the writing competencies of the students are good. However, this data is from design projects submitted by the Raytheon ET training program. The Raytheon students appear to be a more mature set of students that was evaluated in fall 2008.

Action Plan:

The identified weakness was the writing skill. Faculty will need to discuss if first course first semester is the appropriate time to assess the student writing skill. Students typically have not had English I or II.

OBJECTIVES AND OUTCOMES
ASSESSED WITH RUBRIC

Digital Design Lab (CTE103) – Design Project #1

Objectives and Outcomes Assessed with Grading Rubric

The objectives of the Electronic Technology Program include to assist students in the development of:

1) The ability to use a schematic diagram to build and test electrical/electronic circuits and systems.

1.1) The graduating student will be able to demonstrate knowledge and hands on competence in the analysis of digital and analog electronics by the prototyping, testing, troubleshooting and operating of electrical/electronic circuits and systems.

2) The ability to identify, formulate, and solve technical problems.

2.1) Analyze problems, that is, isolate and describe the important components of a problem: what is given (design specifications, performance requirements, testing standards, etc.); what is known from previous experience relevant to the problem; and what the unknowns are.

2.2) Represent the problem in a visual form such as a schematic, flow chart, diagram, or data table. This visualization will represent the components of the problem in a way that leads to the construction of a solution.

2.3) Demonstrate the ability to conduct an experimental procedure, use laboratory materials properly and safely, carefully note observations in a laboratory notebook, and describe the procedure clearly for others.

3) The ability to create and conduct technical experiments and analyze and interpret data.

3.4) Analyze and interpret the data.

6) Critical Thinking Competencies - The ability to evaluate, compare, analyze, critique, and synthesize information.

6.3) Develop a hypothesis or thesis by applying logical, scientific and/or quantitative reasoning.

6.4) Apply logical, critical, and creative thought process to identify problems, make decisions, and develop solutions.

7) Writing Competencies -The ability to produce clear and well-organized writing which responds appropriately to an assignment using standard American English.

7.1) Produce clear and well organized writing that responds appropriately to course assignment.

RUBRIC

Design Project #1 - Design a BCD Invalid Code Detector

Criterion Description	Learning Outcomes	Project Points					Project Score
		0 Unacceptable	2 Incomplete	4 Developing	6 Accomplished	8 Exemplary	
1. Complete the truth table. Generate a Boolean expression from the truth table.	2.1 2.2 6.3						
2. Draw the logic circuit for the simplified Boolean expression using AND -OR logic.	2.1 2.2 6.4						
3. Draw the logic circuit for the simplified Boolean expression using NAND gates only.	2.1 2.2						
4. Make the logic circuit that uses NAND gates only into a wiring diagram	2.2						
5. Construct the NAND gate only circuit and test the operation of the circuit by filling in a truth table with the results.	1.1 2.3 3.4						
6. Draw a logic circuit using an 8-input Multiplexer/Data Selector to implement the Invalid Code Detector truth table. Use the truth table "partition technique".	2.1 2.2 6.3 6.4						
7. Construct the Multiplexer/Data Selector circuit and test the operation of the circuit by filling in a truth table with the results.	1.1 2.3 3.4						
8. Submit a report with the title BCD Invalid Code Detector , your name, the date, a paragraph describing what the BCD Invalid Code Detector does, and the neatly drawn items from steps 1 through 8 which support your design.	7.1						

RESULTS

Design Project #1 - Design a BCD Invalid Code Detector

Fall 2008: Total number of students assessed = 33.

Criterion Description	Learning Outcomes	Project Points – Number of Students Receiving					Students rated at...			
		0 Unacceptable	2 Incomplete	4 Developing	6 Accomplished	8 Exemplary	4 and above		6 and above	
							N	%	N	%
1. Complete the truth table. Generate a Boolean expression from the truth table.	2.1 2.2 6.3	0	0	1	2	30	33	100	32	97
2. Draw the logic circuit for the simplified Boolean expression using AND -OR logic.	2.1 2.2 6.4	2	0	4	7	20	31	94	27	82
3. Draw the logic circuit for the simplified Boolean expression using NAND gates only.	2.1 2.2	0	0	4	3	26	33	100	29	88
4. Make the logic circuit that uses NAND gates only into a wiring diagram	2.2	0	0	4	3	26	33	100	29	88
5. Construct the NAND gate only circuit and test the operation of the circuit by filling in a truth table with the results.	1.1 2.3 3.4	0	0	1	0	32	33	100	32	97
6. Draw a logic circuit using an 8-input Multiplexer/Data Selector to implement the Invalid Code Detector truth table. Use the truth table "partition technique".	2.1 2.2 6.3 6.4	2	0	4	3	24	31	94	27	82
7. Construct the Multiplexer/Data Selector circuit and test the operation of the circuit by filling in a truth table with the results.	1.1 2.3 3.4	2	0	1	0	30	31	94	30	91
8. Submit a report with the title BCD Invalid Code Detector , your name, the date, a paragraph describing what the BCD Invalid Code Detector does, and the neatly drawn items from steps 1 through 8 which support your design.	7.1	2	1	7	11	12	30	91	23	70