Assessment Report

Name of discipline/department/academic unit _____**ECE**_____

1. List the goal(s) that were assessed. Include a brief statement describing how the assessed goal(s) relate to the Goals for the Undergraduate Experience or to the disciplinary goals. (attach additional sheets if necessary)

    1. ECE department completed the development of outcomes and objectives for both the EE and CE programs (see Appendix A). Based on the objectives and outcomes for the two programs, the ECE faculty collectively revised all course descriptions for all its undergraduate courses. In addition to the regular course catalog information, the new course description contains expected outcomes from the course and assessment tools to be used to assess how the students meet the course outcomes. These specific course outcomes are explicitly mapped to the corresponding program outcomes. An example of such course description is in Appendix B.

Note: The outcomes and objectives were revised slightly based on feedback from the department's industrial advisory board.

2. Describe the student population that will be assessed. Are you evaluating all students in your program? If a subset, describe how the subset was selected and why this population is representative of all your students.

All undergraduate students have been assessed in the past one year. Assessment was implemented for every course that was offered during the past year.

3. Assessment tool (method of assessment). Describe how the assessment was conducted. For example, were all students in a particular course in a single term assessed? Was the assessment conducted during an exam or in class? Attach a copy of the tool or method used.

The students in every undergraduate course are assessed through the following procedures:

1. A **pre-requisite test** is given to the students within the first two weeks **of each semester.** The pre-requisite quiz covers ONLY the materials taught in the perquisite classes or related to the prerequisite topics. **Each instructor is requested to analyze the results and take appropriate actions such as:**
    a. For topics missed by the majority of the students, instructor should give a review
    b. For students poor in math, they will be encouraged to take free tutoring sessions offered by the campus. We intend to inform the Math department and seek their help in this regard.
    c. For students poor in engineering prerequisites, they will be encouraged to seek help from the free tutoring program offered by the CECS. Also the instructor will recommend remedial measures for the students that have shown weaknesses in specific topic areas
    d. For students who show significant deficiency, they may be advised to drop the course.
2. The course instructor will administer an outcome assessment quiz by the end of each semester. The instructor must make sure that **every passing student meets the outcome of the course. This has the following implementation steps.**

2.1 At the beginning of each semester,
    a. the instructor must clearly present the objective and expected outcome of the course

b. the instructor must clearly explain how the outcomes are to be achieved, and through what topics to be introduced during the course.
c. the instructor must clearly specify that a quiz will be given near the end of the semester
d. the instructor must clearly state that
    i. the quiz serves as the minimum requirement for passing the course. Therefore **every student who wishes to pass the class must pass the quiz**.
    ii. However, **passing the quiz does not necessarily mean passing the course.**
    iii. **Sample questions are posted on the web site to help students prepare properly for this quiz**

2.2 The course outcome assessment quiz for each course should cover the basic knowledge necessary for assessing all the outcomes identified in the course description.
2.3 Students must demonstrate to the instructor that they indeed meet all the outcomes assessed by the quiz. Students may have multiple opportunities to take the quiz.

Appendix C contains an example of assessment reports.

4. Summarize the data gathered.

ECE has collected assessment reports from each instructor and held a faculty and adjunct faculty retreat meeting to exchange and discuss assessment data. At this retreat, each faculty member presented his/her assessment data and recommendations. See Appendix D for detail.

5. Briefly analyze your results. Indicate if your goal for student learning was achieved.

Pre-requisite quizzes given in most courses show that most students have the necessary background preparation. We did observe the following weaknesses in their preparation:

a. Students need to enhance mathematics background. E100 instructors have recommended that CECS consider Math 105 as a pre-requisite course
b. ECE 210 instructor has identified that students need to have some proficiency in solving physics and calculus problems

The department has found **some anomalies** between regular exam results and the results from the outcome assessment test. In one course, a student maintaining a B average failed the minimal outcome assessment test. In another course, the outcome assessment test was too difficult for most students. The department is addressing these issues in the current semester.

See Appendix D for a full report.

6. Describe the changes that will be made in your curriculum based on these assessment results.

See Appendix E for a full report.

7. What are your assessment plans for next year? Please include the goals to be assessed and the method for assessment.

We will assess every undergraduate course and conduct senior exit survey. Each year, a comprehensive review of our assessment results will be undertaken. A meeting of all faculty (including adjuncts) will be organized in May to hear presentations from all instructors with regard to the assessment results from the previous semesters. Modifications to the curriculum (or implementation of assessment practices) will be voted on. We will also hear presentations from subcommittees that are charged with monitoring specific topic areas such as Circuits and Electronics, Signals and Systems, Computers, Communications and Networks etc.

We also plan to implement a survey of recent graduates to determine if our program objectives are being met. We will conduct a survey of our graduating seniors to determine if our students are achieving the specified program outcomes.

We have developed a new template for reporting the results of assessment in each course. All assessment summaries will use this new template.

We have added a student member to our ABET assessment committee. We are in the process of implementing some changes to our assessment practice to address student concerns.

Appendix A: Objectives and Outcomes of EE and CE program

(a) Graduate engineers who have good design skills, including the ability to formulate problems, design experiments, collect, analyze and interpret data; evaluate material, computational and personnel resources needed to solve typical problems, work in multidisciplinary teams, and communicate effectively. (a-k)
(b) Graduate engineers with the ability to pursue higher education as well as a research career in industry and academia.(a, b, c, e, f, g, i, j, k)
(c) Graduate engineers who have hands-on experience with commonly used industry-standard software and hardware tools. (b, c, h, i)
(d) Graduate engineers who have a good awareness of professional responsibility, ethics and the need to engage in life-long learning.(d, g)
(e) Graduate engineers who are well prepared to meet the needs of region, including automotive construction, power and defense related industries, consistent with the institution's mission. (a, b, c, k, h)
(f) 6a) Graduate electrical engineers that are well grounded in the principles and methods of Electrical Engineering including a good knowledge of Circuits, Communications, Computers and Control Systems, and the ability to apply these in systems, products, and applications.
(g) 6b) Graduate computer engineers with a strong background in computer engineering with a good balance between software and hardware skills including software development, design of digital systems, microprocessors, embedded systems, real-time control and digital communication networks.(a, b, c, f, h, i, k)

Program Outcomes and Assessment

The Computer Engineering and Electrical Engineering programs are designed to demonstrate that their graduates have:

(a) a strong background in mathematics and physical sciences and a good understanding of their importance to electrical and computer engineering disciplines
(b) an ability to formulate problems, design experiments, collect, analyze and interpret data and use this knowledge to design a system, component, or process to meet desired needs
(c) an ability to function on multi-disciplinary teams
(d) an understanding of professional and ethical responsibility
(e) proficiency in oral and written communications
(f) the broad education necessary to understand contemporary issues and the global impact of engineering and technological developments in societal context
(g) a clear understanding that lifelong learning is essential for sustained professional development
(h) an ability to use the techniques, skills and modern engineering tools necessary for engineering practice

(i) an ability to recognize a problem, formulate different strategies to understand the problem and use engineering principles to solve the problem

(j) an ability to apply mathematical methods and physical properties of components and devices to develop an in-depth understanding of circuits, electronics, computers, communications and control systems (**for students in the EE program**)

(k) an ability to apply mathematical methods and physical properties of components and devices to acquire an in-depth understanding of digital circuits, computers, communication networks, embedded systems, real-time systems and software development skills (**for students in the CE program**)

Appendix B: Course Description with course outcomes and assessment tools

Catalog Data (Revised 2001-03)	**210 Circuits** Prerequisite: Preceded or accompanied by Physics 151 and preceded by Math 116 or equivalents. (4) Fundamental laws, electrical elements and sources, energy and power. DC analysis of linear circuits. Node and mesh analysis. Operational amplifiers and op-amp circuits, Thevenin and Norton theorems. Sinusoidal steady-state response and the phasor concept. Introductory concepts on complex frequency, average power in AC circuits. First and second order circuits. *Three lecture hours per week and one three-hour laboratory per week.*
Textbook	J. David Irwin, "Basic Engineering Circuit Analysis," 6-th ed., Prentice Hall, 2001
Coordinators	Profs. John Shen and M. Shridhar, Electrical and Computer Engineering
Prerequisites by Topic	1. Introductory complex algebra, calculus 2. Introductory physics
Topics	3. Basic electrical concepts, current, voltage and power (3 hours) 4. Ohm's Law, Kirchhoff's laws for analysis of circuits (4 hours) 5. Node and mesh analysis, circuit theorems (6 hours) 6. Introduction to operational amplifier circuits (4 hours) 7. Inductance and capacitance; source free first order circuits (4 hours) 8. Forced/natural, transient/steady state response (3 hours) 9. Sinusoidal steady-state, phasor, impedance and admittance (8 hours) 10. Resonant circuits and Frequency response (4 hours) 11. RMS values, average power and, power transfer (3 hours) 12. Exams (3 hours)
Laboratory projects:	One and two-week experiments covering such topics as Laboratory instrumentation, Operational amplifier circuits, Experimental verification of basic theory (Ohms law, Superposition, etc., Sinusoidal amplitude and phase, transients (RL, RC, RLC), Circuit analysis; correlation of analytical, computational, and experimental evaluations, Selected design topics
Computer Usage	SPICE analysis of electric circuits, project reports
Course Objectives	13. Proficiency in the analysis of AC and DC circuits 14. Proficiency in the construction, testing and verification of circuits 15. Proficiency in the use of electronic equipment including power supplies, signal generators, oscilloscopes and other measuring instruments
Course Outcomes	1. Ability to analyze DC linear circuits using basic circuit theory and mesh/node analysis techniques. (Outcomes: a, h, i, j) 2. Ability to evaluate sinusoidal steady-state AC analysis using the concepts of phasor representation, impedance and admittance (Outcomes: a, h, i, j) 3. Ability to derive Thevenin and Norton equivalent models for simple circuits 4. Ability to evaluate frequency response both analytically and experimentally. (Outcomes: a, h, i, j) 5. Ability to analyze basic op-amp circuits, using ideal op-amp models. (Outcomes: a, h, i, j) 6. Ability to use SPICE to analyze electrical circuits (Outcomes: a, b, h, i, j) 7. Ability to use electronic instruments to measure and test DC, AC, and transient circuits. (Outcomes: a, b, h) 8. Ability to design a simple circuit through a project related to circuits and write project report. (Outcomes: b, h, i, k, e)
Assessment Tools	1. Exams and frequent quizzes (1-5) 2. Reports from laboratory and project assignments (1-8) 3. Instructor will conduct several informal course evaluations during the term of the course and use student feedback to enhance the course. 4. Assessment reports from follow-on courses, especially ECE 311 and ECE 317 are used to enhance the content of ECE 210.

Appendix C: An Example of Course Assessment Report

ECE 375 Assessment Summary
Winter, 2002

Instructor: D. Bridges

Prerequisite Quiz:

- The quiz was announced during the first week of class, and prerequisite material was reviewed during the first two weeks of class.
- The quiz was given on Wednesday, January 23, 2002. This was during the third week of class.
- The quiz tested the following ECE 273 topics:
  - Combinational logic design
  - Multiplexers
  - General logic gates (AND, OR, NOT, XOR, etc.)
  - Conversions between number systems
  - Decimal equivalents for two's complement numbers
- The overall analysis of the results were as follows:

Students did well overall. Of the students that did not do as well, the main problem areas were multiplexers, number conversions (especially between hexadecimal and binary) and two's complement (especially not understanding the meaning of the most significant bit). This feedback has been discussed with the course coordinators for ECE 273.

Final Assessment Quiz:

- The final assessment quiz was announced from the beginning of the semester, and was given on Wednesday, April 10.
- The attached review sheet was posted on the web for students to use in preparing for the quiz.
- The basic items tested on the quiz were:
  - The role of memory in basic instruction execution (Outcome 1)
  - Designing a mini register-based system (Outcomes 1 and 2)
  - Simple ALU design (Outcome 3)
  - Hard-wired vs. Micro-programmed control (Outcome 4)
- Other outcomes (especially outcome 5) were tested more thoroughly with projects.
- A number of students misunderstand what the first question was asking for. It was a new type of question that they had not seen before, and should have been included on a previous exam, quiz or homework problem.
- All students who did not get 100% on the quiz were able to demonstrate their proficiency in the subjects missed – either by oral quiz or by completing another similar problem.

Projects:

- There were a total of three projects in the class, covering
    - Basic Data Processing Unit (DPU) design with a register file and ALU (Outcomes 2 and 3)
    - Design and simulation of a simple hard-wired CPU (Outcomes 1, 2, 3 and 5)
    - Design and simulation of a simple micro-programmed CPU (Outcomes 4 and 5)
- These projects covered all aspects of the ABET outcomes for the course

Homework and Laboratory Assignments:

All homework was recommended, but not required. Solutions were posted for all problems and many quiz and exam questions were based on the homework.

Self-Assessment:

Self-assessment on prerequisite material was not performed this semester.

Exams:

There were a total of three exams in the course. These covered the following outcomes:

- Exam 1: Outcomes 1, 2 and 3
- Exam 2: Outcomes 1 and 2
- Exam 3: Outcomes 1 and 4

Appendix D:
Summary of ECE Course Assessment and Actions taken based on Assessment

E100

a. Instructor suggested that Math 105 would be a good pre-requisite.
   Response: Dr. Shridhar will bring this up at the college level.
b. Instructor observed the students had very limited vocabulary. He will prepare a list of scientific and engineering terms at the class website to help students improve writing skills.

ECE 210

c. Pre-requisite test assessment:
   - Good preparation in linear algebra
   - Reasonable preparation in complex number
   - Poor preparation in calculus
   - Very poor preparation in high school or PHY 151. Most students could not answer basic questions on current, voltage or Ohm's law.

   Actions:
   - Assessment results have been communicated to the students in the class. The students were asked to review these subjects as part of the homework assignment.
   - The students were informed of the tutoring service available to them in math.

ECE 319

The instructor the course currently has ECE 210 as its only pre-requisite. Students must know the following topics before taking the class:

- Additional studies and exercises in basic DC and AC circuit characteristics, with increased emphasis on resonant circuits.
- Knowledge of electronic hardware manufacturing methods and techniques.
- Familiar with circuit board characteristics and hardware assembly practices.
- Introduction to semiconductor analog and digital circuit operation and characteristics.
- The instructor also pointed out that due to the lack of formal laboratory, certain concepts were introduced through frequent in-class demonstrations.

Faculty members at the meeting pointed out that these topics are covered by ECE 311. Faculty members suggested the following changes of the course

- Students need to have ECE 311 prior to this course.
- Upgrade the course number
- Add a lab session in this course

Response:

- Will add ECE 311 as a pre-requisite course staring in Winter 2003
- Will add a lab session in this course in Fall, 2003.
- Course number will stay the same.

ECE 270, 370 and 370

Since these three courses will be merged into two: ECE 270 and 370, a subcommittee chaired by Professor John Miller with members Larry Sieh (Adjunct) and Professor Dongming Zhao.
The issues raised by courses that require these courses as pre-requisites:

- Students need more train in C++ programming on different operating systems
- Students need to know more about pointers
- Students need to know call by name and call by reference.
- Students need to know more on data structures

ECE 375

ECE 375 has pre-requisites courses ECE 273 and co-requisite ECE 373

Through the pre-requisite test, the instructor discovered that the students were weak in the following topics:

- Multiplexers
- Hex / Binary conversions
- Two's complement numbers

The instructors of ECE 273 and ECE 373 pointed out at the meeting that the first two topics were currently covered. It has been agreed that Two's complement numbers will be covered in ECE 273.

Response: Two's complement numbers will be covered in ECE 273 in fall 2002.

ECE 385

The instructor observed through the pre-requisite quiz that Many students do not feel a responsibility to retain in their memory fundamental definitions and formulas. Too many are unable to apply Ohm's Law to a simple dc circuit. Too many do not remember definitions of impedance and admittance and can not write the simple formulas for the reactance of an inductor, L, or a capacitor, C, in terms of the angular frequency of an ac signal.

Suggestions:

- Prerequisite courses should place a greater emphasis on retaining definitions and basic formulas as a permanent part of an individual's intellectual equipment.

- During the term students should be continuously reminded that the final exam is closed book with no form of "cheat sheet". They are expected to remember basic definitions and related simple equations

ECE 415

Through the pre-requisite quiz, the instructor found that quite a few students had difficulties in performing op-amp analysis and the analysis of AC circuits in terms of the complex calculations. In general the students need to enhance their math background.

The instructor took the following actions:

1- reviewed rms values, ac power, transients of capacitors and inductors.
2- Encouraged those students who were weak in math, including integration, rms value, average, linear function, etc, to take tutorial from the math department to from the instructor himself.
3- Encouraged the students who did very poorly in the pre-requisite quiz to take tutorial help from the instructor himself or from the CECS.
4- Asked the students to review the relevant material needed as non-prerequisite material such as PI controllers, etc.

The instructor made the following recommendations to the two pre-requisite courses

ECE 210

- emphasize on AC circuits, including rms values, AC power
- introduce PI design and analysis using op-amps

ECE 311

- Introduce basic power modules such as IGBTs, MOSFETs, etc.
- Introduce some non-linear power devices circuit analysis

The instructor also made the following suggestions to change the content of this course:

- Drop the resonant converters topic
- Only introduce motor drive application as practical examples
- Add Two-quadrant chopper topic to the class
- Add a lab session to this course

Response:

- Change pre-req. to ECE 317, 385. This will be effective in Fall 2003

- Resonant converter topic will not be covered in this course. This is effective immediately.
- It is not necessary to have a formal lab at this point

ECE 471

The instructor was quite innovative in course Outcome assessment.
The course has four expected outcomes:

- The Fundamentals: assessed Key Competency Quiz
- Emerging Technology: not tested
- Design Skills: Demonstrated by projects
- Engineering Principals and Solving Communications Problems: Demonstrated by projects, Key Competency Quiz:

In the outcome assessment quiz, each topic was assigned three questions. A student passes the test if he/she gets 2/3 correct in very topic.

ECE 473

Through the pre-requisite quiz, the instructor found the following weaknesses in the students

- 68HC11 programming skills were rusty
- Using interrupts in assembly language
- Confusion about variable size declarations in C (char, int, double, etc.), since some can vary between compilers
- Using pointers in C
- Call-by-reference parameter passing in C

To address these issues, faculties at the meeting suggested the following changes to the course:

- Add ECE 210 as a pre-requisite course to cover the last three issues
- The first topic is covered by the ECE 373.

ECE ABET committee needs to decide whether ECE 210 should be a pre-requisite course. However the subcommittee still needs to decide whether the last topic should be included in the new ECE 210.

Appendix E
Changes made based on assessments of course outcome

ECE 210

1. emphasize on AC circuits, including rms values, AC power
2. introduce PI design and analysis using op-amps

ECE 273

1. Two's complement numbers should be covered

ECE 311

1. Introduce basic power modules such as IGBTs, MOSFETs, etc.
2. Introduce some non-linear power devices circuit analysis

ECE 319

1. Add ECE 311 as a pre-requisite course staring fall 2002
2. Will add a lab session in this course in fall, 2003 and will add one more credit hour in Fall 2003.

ECE 370/270 (please work out what topics should be covered in 270 and others to be covered in 370. I need your feedback)

1. Students need more train in C++ programming on different operating systems
2. Students need to know more about pointers
3. Students need to know call by name and call by reference.
4. Students need to know more on data structures

ECE 415:

1. Change pre-req. to ECE 317, 385. This will be effective in Fall 2003
2. Resonant converter topic will not be covered in this course.

ECE 437:

Instructor has been asked to give feedback on whether to include ECE 210 in pre-requisite reuirements

ECE 465

Add 317 as a new pre-requisite

ECE 498

Two new design courses will replace the current ECE 498 effective summer 2003 The changes were prompted by faculty observations that some students in the senior design course did not have the requisite background to undertake engineering design objectives

ECE 4985 for EE majors
ECE 4986 for CE majors

Pre-requisites for these two courses are;

- For ECE 4985: comp 270, ECE 317, ECE 372 and (ECE 450 or ECE 460)
- For ECE 4986: comp 270, ECE 311, ECE 372 and ECE 375 and (ECE 471 or ECE 475)