MEMORANDUM

To: Engineering Department faculty
From: Engineering Assessment subcommittee
Re: Assessment and ABET 2000
Date: May 25, 1999

Attached to this document are the new criteria for accrediting programs in engineering – called ABET 2000. These are the criteria we will have to meet on our next accreditation visit. The primary change that we have to make to the way we do business is that we need to increase our assessment activities and we have to show that assessment results produce program improvement.

A. Program Educational Objectives:

Criterion 2 of ABET 2000 states the following:

> *Each engineering program for which an institution seeks accreditation or reaccreditation must have in place*
>
> ***a)*** *detailed published educational objectives that are consistent with the mission of the institution and these criteria,*
>
> ***b)*** *a process based on the needs of the programs various constituencies in which the objectives are determined and periodically evaluated,*
>
> ***c)*** *a curriculum and process that ensures the achievement of these objectives, and*
>
> ***d)*** *a system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program.*

Proposal 1: Every 6 years the Engineering Department faculty will review its program philosphy and objectives. This review will include input from students, Advisory Council members, and employers. This review should ideally take place at a time mid-way between accreditation visits.

A program objective review took place recently on May 5, 1998. The particpants included Engineering faculty (Robert Hoeksema, Steve Vander Leest, Andrew Blystra, Wafeek Wahby, Brian Post), engineering students (Grace Trevino, Dean Ter Haar, Eric Vander Ploeg, Lora Vanden Berg, Steve Waalkes, Dan Gritter), and CEAC members (Thomas Vanden Berg, Chuck Spoelhof, and Nick Hendriksma).

On April 12, 1999 the Engineering Department met to discuss program philosophy, objectives and desired student outcomes. The results of these two meeting are the following statements:

Engineering Program Philosophy and Objectives

The core philosophy of the Calvin College Engineering Program is that engineers are designers. Engineering courses are then taught within a design perspective showing how the various topics lead to, broadly speaking, specification of size, shape, and material of technological products. These objects function as a matter of course in all of reality, hence they inherently possess a unity of ideas from the mathematical to the political. This unity motivates an engineering design curriculum that includes excellence in analysis, problem solving, and the liberal arts and that emphasizes the integration of courses within an Engineering specialty as well as across the engineering concentrations offered. This emphasis on unity arises from a faith that all of creation is unified in Christ. Further, within creation, humans are given to be image bearers of their creator. This, in turn, entails a responsibility toward people and the natural world particularly when technologies are designed and inserted into the world. To emphasize this responsibility, engineering design is viewed as a vocation, a redeeming influence, and a calling of God.

To that end, those graduating with a BSE degree from Calvin College will be:
1. individuals who are firmly grounded in the basic principles and skills in engineering, mathematics, science, and the humanities, for correct, perceptive, and sensitive problem assessment at a level appropriate for both entry level work in industry and in graduate school;
2. designers who are able to creatively bring a project from problem statement to final design while realizing the interdisciplinary and interdependent character of the engineering profession;
3. servants whose Christian faith leads them to an engineering career of action and involvement, to personal piety, integrity, and social responsibility.

Program Outcomes

Calvin's engineering program will demonstrate that its graduates have

(a) an ability to apply knowledge of mathematics, science, and the engineering sciences as appropriate guidelines for design decision making,
(b) an ability to design and conduct experiments, as well as analyze and interpret data to extract meaning,
(c) an ability to design a system, component, or process to meet desired needs and to produce a prototype or model which can effectively test the basic principles of the design,
(d) an ability to function on multi-disciplinary teams,
(e) an ability to identify, formulate, and solve engineering problems using fundamental principles,

(f) an understanding of professional and ethical responsibility from a Christian, holistic perspective,
(g) an ability to communicate truthfully and effectively,
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context including an understanding of Christian stewardship of resources,
(i) a recognition of the need for, and an ability to engage in life-long learning, to aid in the fulfillment of their calling,
(j) engaged contemporary issues demonstrating how their Christian faith relates to their profession,
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice to develop responsible technologies, and
(l) significant exposure to the engineering profession.

Proposal 2: The Engineering Department program philosophy and objectives must be publicly available through the college catalog, department promotional materials, department Web page, and other forms of mass communication. This statement of departmental philosophy, objectives, and outcomes will be reviewed with students as they enter engineering at Calvin and once again as they enter their concentration.

Proposal 3: The Engineering Department will periodically (every 2 or 3 years) review the way in which the overall engineering program seeks to meet the program philosophy and objectives.

Proposal 4: The Engineering Department will develop an assessment plan that will allow it to continually upgrade and improve its curriculum and program.

B. Program Assessment

Criterion 3 of ABET 2000 covers Program Outcomes and Assessment. The ABET required program outcomes are completely covered by the departmentally approved program outcomes given above. Criterion 3 also requires an assessment program. Specifically:

Each program must have an assessment process with documented results. Evidence must be given that the results are applied to the further development and improvement of the program. The assessment process must demonstrate that the outcomes important to the mission of the institution and the objectives of the program, including those listed above, are being measured. Evidence that may be used includes, but is not limited to the following: student portfolios, including design projects; nationally-normed subject content examinations; alumni surveys that document professional accomplishments and career development activities; employer surveys; and placement data of graduates.

The assessment program must include a number of tools (or activities) which provide the data necessary to assess program effectiveness.

Proposal 5: An engineering faculty member (the assessment coordinator) will be in charge of monitoring all assessment activities. The most critical activity is to make sure that assessment results are used to improve the program and that all assessment activities are properly documented. Appropriate course load reduction (or other form of compensation) for these activities will be requested from the administration.

Proposal 6: The Engineering Department must perform the following assessment activities:

a) **Student evaluations for every course for every semester. Student evaluations of individual courses will have two components. The first component assesses the instructor's ability to teach the course. This will be done with the standard, college-wide, course evaluation form. The results of this evaluation will be reviewed by the academic dean, by the department chair, and by the faculty member following existing college procedures. Problems noted by either the dean or the chair can then be addressed directly with the instructor. The second component of the course evaluation addresses the course itself. This will be done with a departmentally prepared evaluation form. The form will be completed at the time of the college evaluation but returned to the assessment coordinator. These completed forms will be given back to the instructor after grades are completed and used by the instructor to complete the faculty course evaluation (item b below). The questionnaire used by each course will be based on a standard set of questions agreed upon by the department. These questions can then be modified to accommodate the particular needs of the course (i.e. eliminate questions about lab for a course that has no lab). (Time and frequency: December, February, and May every year).**
b) **Faculty course evaluations. At the end of the semester each faculty member (or faculty team for multi-section courses) will summarize the objectives and outcomes of each course taught. The review should include the objectives of the course, what was done to meet these objectives, an assessment of how well the course met the objectives and suggestions for change next time that the course is taught. Comments and input from the student evaluations should be included in this evaluation. The student evaluations should be attached to the faculty report. These reports will then be forwarded to the faculty teaching the course the next time it is offered. The report can also be forwarded to others as indicated by the faculty member involved (e.g. the instructors for Engineering 102 may want to**

forward information to Engineering 101 instructors or Engineering 204 instructors may wish for the Physics 225 instructors to read the review). (Time and frequency: December, February, and May every year).

c) CEAC review of major program changes. These changes must be presented to the Calvin Engineering Advisory Council (CEAC) for review. (Time and frequency: November and March every year).

d) End of year assessment questionnaire for first and second year students. The primary goal of this questionnaire is to determine the effectiveness of the first two years of our program. The major goals are academic program improvement, student retention, and understanding the basis of concentration choice. (Time and frequency: May every year).

e) Senior assessment survey. The goal of this survey is to review the entire program as to whether the program objectives and outcomes have been meet. The seniors will also be surveyed to determine job placement and graduate school acceptance. (Time and frequency: May every year).

f) Graduate assessment survey. The goal of this survey is also to do a review of the entire program as to whether the program objectives and outcomes have been met from the perspective of more experienced engineers. This should be done every year with the graduates from the class 3 years prior and 10 years prior. (Time and frequency: May every year).

g) Senior Design reviews. The assigned Senior Design faculty, the professional review consultant, and other engineering faculty will review the results of the senior design projects. The review will primarily focus on the team's ability to design a system, component, or process to meet desired needs. It will also address other pertinent program outcomes. Senior design materials will be archived for ABET review. The assessment coordinator will review various inputs for suggestions for change. (Time and frequency: May every year).

h) FE exam outcome review. The FE exam results should be used to highlight specific problems in course coverage. (Time and frequency: Every year upon receipt of exam results).

i) Library assessment. The library staff can compare our engineering library holdings and access to technical information to those of similar engineering institutions. This should be done regularly to make sure that we have an adequate library collection. (Time and frequency: June every third year).

j) **The results of outside grading of lab reports for technical writing content will be used to assess our graduates' communication skills. (Time and frequency: administered to juniors every spring semester).**

The following table shows that the above assessment tools can adequately cover all of the desired program outcomes. Those marked with a "**d**" provide direct evidence while those marked with "**i**" provide indirect evidence.

Assessment Activity	Desired Program Outcomes											
	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
Student evaluations	**i**	**i**	**i**		**i**	**d**				**d**	**i**	**i**
Faculty course evaluations	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**		**d**	**d**	**d**
CEAC review	**i**	**i**	**i**	**i**	**i**		**i**	**i**	**i**	**i**	**i**	**d**
First and second year student survey												
Senior survey	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**
Graduate survey	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**
Senior Design review	**d**	**d**	**d**	**d**	**d**	**d**	**d**	**d**		**d**	**d**	
FE exam outcome review	**d**				**d**	**i**						
Library assessment								**i**	**i**			**i**
Technical writing review							**d**					

Proposal 7: Every fall all of the assessment results will be summarized in a single report. This report will be reviewed (and modified) by the engineering faculty. It will then become the report submitted each year to the college-wide assessment committee. The assessment coordinator will prepare this report.

Proposal 8: This assessment process requires several surveys. These include the following:

- **First year program survey**
- **Sophomore survey**
- **Senior surveys**
- **Recent graduate survey**
- **10-year graduate survey**
- **Basic questions for course evaluations.**
- **Format of faculty course assessments**

The current versions of these surveys are attached to this document for review and approval. These documents should be reviewed and updated on a yearly basis.