

Contact: Diana Gonzalez

**ENGINEERING PROGRAMS ACCREDITATION REPORT**  
**AT IOWA STATE UNIVERSITY**

**Action Requested:** Receive the accreditation report from the Engineering Programs in the College of Engineering at Iowa State University.

**Executive Summary:** The College of Engineering offers bachelor of science in engineering degrees in ten areas - Aerospace Engineering, Agricultural Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Construction Engineering, Electrical Engineering, Industrial Engineering, Materials Engineering, and Mechanical Engineering.

All of the programs (1) underwent a self-study that addressed the criteria defined by the accrediting body; and (2) had an on-site visit by peer evaluators. The programs were accredited for the maximum period. There were no deficiencies<sup>2</sup> or weaknesses<sup>3</sup> identified for any of the programs. Concerns<sup>4</sup> were identified for three programs (Aerospace Engineering, Agricultural Engineering, and Construction Engineering). There were observations<sup>5</sup> identified for six programs (Chemical Engineering, Computer Engineering, Construction Engineering, Electrical Engineering, Industrial Engineering, and Materials Engineering). This report addresses the Board's Strategic Plan objective (1.1) to "offer high-quality programs through ongoing program improvement for undergraduate, graduate, professional, and non-degree students and special school students."

**Background:**

- ◇ **Description.** Engineering is the application of science and mathematics to solve problems for society.
- ◇ **Purpose of Accreditation.** An accredited educational program is recognized by its peers as having met national standards for its development and evaluation. To employers, graduate schools, and licensure, certification, and registration boards, graduation from an accredited program signifies adequate preparation for entry into the profession. In fact, many of these groups require graduation from an accredited program as a minimum qualification.
- ◇ **Accrediting Agency.** The accrediting body is the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

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<sup>2</sup> A deficiency indicates that a criterion, policy, or procedure is not satisfied. Therefore, the program is not in compliance with the criterion, policy, or procedures.

<sup>3</sup> A weakness indicates that a program lacks the strength of compliance with a criterion, policy, or procedure to ensure that the quality of the program will not be compromised. Therefore, remedial action is required to strengthen compliance with the criterion, policy, or procedure prior to the next evaluation.

<sup>4</sup> A concern indicates that a program currently satisfies a criterion, policy, or procedure; however, the potential exists for the situation to change such that the criterion, policy, or procedure may not be satisfied.

<sup>5</sup> An observation is a comment or suggestion that does not relate directly to the accreditation action but is offered to assist the institution in its continuing efforts to improve its programs.

- ◇ Review Process. The self-studies prepared by the Engineering Programs contained the responses to the criteria required by the accrediting body – students; program educational objectives; program outcomes and assessment; professional component; faculty; facilities; institutional support and financial resources; and program specific criteria.
- ◇ On-Site Team Report. In October 2006, the visiting team determined that the Engineering Programs met the requirements for accredited status.
- ◇ Sample Institutional Strengths Identified by the Visiting Team.
  - ☑ “Project LEARN, originally started in the College of Engineering, is an exemplary program that the entire ISU community now benefits from and which is transforming and enhancing student learning at ISU.”
  - ☑ “Facilities and infrastructure in the college are of very good quality and two departments will be getting new buildings before the next visit.”
- ◇ Sample Program Strengths Identified by the Visiting Team.
  - ☑ Aerospace Engineering. “Student academic and curricular advising in the program is strong and the department uses its required seminar program as an effective means of communicating important curricular information to its students.”
  - ☑ Agricultural Engineering. “The agricultural engineering program includes an excellent internship and cooperative education program. This program has been used to allow students to gain valuable real-world experiences used to develop the core competencies needed for engineering practice following graduation.”
  - ☑ Chemical Engineering. “The program has a well-documented assessment process. Feedback is used to make changes in the curricula and introduce other improvements in the program. Employers of cooperative education students and interns are also part of the assessment process.”
  - ☑ Civil Engineering. “The students’ participation and passing rates in the Fundamentals of Engineering examination is exemplary.”
  - ☑ Computer Engineering. “A flexible and broad curriculum provides multiple options for students to customize the program to their own needs and interests.”
  - ☑ Construction Engineering. “The program maintains strong ties with the construction industry as one of its constituents. An active Industry Advisory Council provides regular input to the program. The program has a long history of assessing performance of their graduates with input from employers. The faculty is also dedicated to the continuous assessment and improvement of the degree program. Students and the program benefit from the diverse and appropriate engineering backgrounds of the faculty, the previous industry experience of the full-time faculty, and the long and continuing industry activity of the adjunct faculty.”
  - ☑ Electrical Engineering. “The program of study in electrical engineering revolves around a central core of essential electrical engineering courses. Beyond this core, students complete their program with 27 credit hours of technical electives. This allows students to shape their program to their interests and better prepare them for their future careers.”

- ☑ Industrial Engineering. “The Problem Solving Learning Portal is an innovative approach to teaching problem solving skills using ill-defined problems and web-based feedback mechanisms which can be used by the faculty to evaluate student learning. Faculty members from the College of Education and the Psychology Department have been consulted to help with the assessment of learning, and the use of rubrics demonstrates the consistency of measurement techniques throughout the program. This system has been adopted by programs in other areas, such as physics.”
- ☑ Materials Engineering. “The program offers several different specializations that allow the student to choose two of four areas – polymers, ceramics, metals, and electronics. This allows the students the flexibility to specialize in areas of their liking and strengths.”
- ☑ Mechanical Engineering. “Excellent performance by the students in the Fundamentals of Engineering examination is commendable. Since 2001, the passing rates for students who took the examination have been in the range of 90 to 100 percent, which has consistently exceeded the national averages.”

◇ Program Concerns Identified by the Visiting Team.

- ☑ Aerospace Engineering.
  - 📖 Program Outcomes and Assessment. “The program outcomes of the program are well defined. However, the process used to assess the degree to which these are met appears to rely very heavily on student feedback via an assessment of ‘comfort levels.’ This assessment process appears to depend more on how students feel about their ability to meet the defined outcomes than on an objective measurement of these abilities. The assessment process appears to rely almost exclusively on student responses to surveys and could greatly benefit with the inclusion of assessment from other program constituencies such as employers of the department’s graduates. *The strengthened process developed by the University is providing valuable information for the betterment of the program but this shortcoming, originally identified as a weakness, remains a concern.*”
  - 📖 Students. While the departmental advising program is thorough in content and in its general delivery, students complain that the use of a single advisor for over 300 students precludes timely access to advising during peak periods such as registration times. *The program states that it has plans to address this issue in the 2007-08 academic year by hiring a new full-time advisor. This concern remains unresolved because the hiring plan has not been implemented.*”
  - 📖 Program Educational Objectives. “Many of the stated curricular objectives appear vague and difficult to measure in a meaningful manner. More direct measures of success that reflect the needs of all the program’s constituencies seem to be needed. *The program reports that it has initiated a process to redefine its program educational objectives no later than the deadline for printing of the university’s 2009-11 catalog and to create a more formal process of evaluation. This concern remains unresolved because these actions have not yet been implemented.*”

📖 Professional Content. “ABET requirements include one year of a combination of college-level mathematics and basic sciences. The department’s use of the course Numerical Methods as a basic math course to allow the program to meet ABET professional component requirements seems questionable. It is also questionable whether the identified basic math topics covered in the course are actually being taught to the students for the first time or merely being reviewed as needed for the proper presentation of the computational methods covered in the course. *The program responded that there is sufficient math content in other courses to alleviate any shortage of ABET mandated math and science coverage. This concern remains unresolved.*”

☑ Agricultural Engineering.

📖 Program Outcomes and Assessment. “A process is in place to assess program outcomes through the assessment of core engineering competencies, and results are being used to improve the program. However, the improvement process needs to be formalized to insure its timely operation and uniform application across the curriculum. *The program has provided information that indicates the improvement process has been formalized to insure its timely operation and uniform application across the curriculum. However, full implementation of this process through an assessment cycle has not taken place and this concern remains unresolved.*”

☑ Construction Engineering.

📖 Professional Component. “This criterion states that ‘one year of a combination of college level mathematics and basic sciences’ is required. The mathematics and basic science content found appears to be less than the criteria requirement. *The program has detailed a short-term and a permanent remedy for the shortfall in mathematics and basic science. Because the permanent means of addressing this shortcoming has not yet been put in place, this issue, originally identified as a weakness, remains as a concern.*”

◇ Program Observations Identified by the Visiting Team.

☑ Chemical Engineering.

📖 “Only one non-chemical engineering course is required. This limits student opportunity to function on a multi-disciplinary team, such as in a non-chemical engineering laboratory course. Also, organic chemistry laboratory is not required, limiting student exposure to experimental chemistry. Materials science is also not required. However, program electives can be used to provide student exposure to the above areas.”

📖 “Program educational objectives could be strengthened by being more forward looking, e.g., focusing on expected achievements of graduates and addressing changing opportunities and roles for chemical engineers.”

📖 “A survey of employers of graduates along with more frequent alumni surveys would provide additional assessment of program educational objectives.”

📖 “Inclusion of environmental, safety, and health consideration in the direct course assessment rubrics for evaluating the appropriate outcome is recommended.”

- “While the department advisory council membership is impressive, their role and perspective might be enhanced by including non-Iowa State University alumni, government agency, and non-traditional employers.”
- Computer Engineering.
  - “Interviews with students and faculty show that an increase in the number of teaching assistants would improve the support for the students and provide more time to faculty for lecture preparation. The limited English proficiency of some of the teaching assistants was also raised by student interviews.”
- Construction Engineering.
  - “Faculty resources available to the program have improved in recent years in relation to student loads. However, the student loads remain heavy. Continued improvement should remain a priority to allow appropriate time for faculty to also meet expectations of scholarship.”
- Electrical Engineering.
  - “A process of ongoing evaluation of the educational objectives has been established and is being followed. However, this process was reported in the self-study mainly as minutes of the meeting in which the process was approved by the faculty of the department. The process should also be separately stated and diagrammed to avoid any possible confusion.”
- Industrial Engineering.
  - “While the program educational objectives are forward-looking and developed in consultation with appropriate constituent groups, these objectives might provide better guidance if expressed with more emphasis on achievements of graduates. In evaluation of these objectives, the program is encouraged to develop more fact-based data sources and survey questions to complement the existing reliance on satisfaction and appropriateness of objectives.”
  - “Lengthy university catalog review cycles can result in superseded language when program educational objectives are published there. Care needs to be taken to insure, to the extent possible, that all statements of program educational objectives and program outcomes are consistent and current.”
  - “The program has utilized the flexibility offered by the engineering accreditation criteria by adding outcomes to the required set to better reflect what is unique about the program. Their extensive use of rubrics in assessment provides a flexible, meaningful, and manageable approach to assessment of student outcomes without adding excessive burden to the faculty.”
- Materials Engineering.
  - “Added personnel would increase the experience depth in polymers. Presently, the department chair is actively looking to strengthen this area.”

- ◆ Accreditation Status. In August 2007, the Engineering Accreditation Commission of ABET awarded accreditation to the Engineering Programs at ISU for the maximum period. No focused reviews or interim reports are required.

Details about the accreditation report are available in the Board Office.