

<b>School</b>	<b>Business, Agriculture, and Technical Studies</b>
<b>Program Area</b>	<b>Engineering Technology</b>
<b>Major Programs</b>	<b>A.A.S. Engineering Technology – Drafting and Design Concentration (63 credits), Credit Diploma, Engineering Technology (28 credits)</b>
<b>Review Period</b>	<b>Fall 2012 to Fall 2017</b>
<b>Self-Study Developed</b>	<b>AY 2017-2018</b>
<b>Review Status</b>	<b>Academic Standards Accepted the Program Review Contingent Upon Submission of a Follow-Up Report</b>
<b>Program Leaders</b>	<b>DeeJaay Beals</b>
<b>Committee Chair</b>	<b>Cindy Henning</b>
<b>Academic Standards Program Review Subcommittee Reviewers</b>	<b>Maura Hadaway: Librarian Clark Harris: VP, Academic Affairs Kim Bender: AVP – Institutional Effectiveness Erin Bauer: Chair of SLA Committee Jesse Brumfield: Student Services Representative Sabrina Lane: Administration and Finance Representative</b>

#### A. Brief Overview of Program

The Engineering Technology Program began in the fall semester of 1978 in response to community demands for Engineering Technology Drafters and Surveying Technicians. New courses are continually being developed for the curriculum in an attempt to keep up-to-date with the continual evolution of technology. Since the conceptualization of the program, classes have been scheduled at nontraditional times to meet the needs of the students and industry. The program employed a stack course system in order to provide a nine-month certificate, but the program has since moved away from the stack course system due to new administrative policies. The program still continues to offer courses at nontraditional times. Classes are offered from the beginning of the afternoon until well into the evening. This allows students to either work at internships or enroll in general education classes in the morning.

There has always been one faculty member for the Engineering Technology Program. Dick Krahenbuhl was the first faculty member to manage the program and teach the courses. He also marketed the program and supervised students who enrolled in cooperative education. In addition, he established contacts with the professionals in the field and recruited some of them to serve on the program's advisory committee. Dick Krahenbuhl retired as the instructor of Engineering Technology in May of 1996 and Jim Jeffers, who was the Construction Trades instructor at the time, was then hired as the full time instructor. In January 2003, Mr. Jim Jeffers passed away and Dr. David (DeeJaay) Beals was hired as interim instructor for the spring 2003 semester. Dr. Beals was later hired full time and currently performs all the services for the program.

The program outgrew its initial facilities and was moved to various locations around campus to find an ideal place to house it. This problem was addressed with the addition of the Flexible Technology building and will be addressed later in the section on facilities. The program was expanded to include needed surveying courses that are required by the Wyoming State Surveyors Board of Registration for Professional Engineers and Professional Land Surveyors. The students in the program find employment while they are still enrolled in the program. It has become a challenge to retain these students since they are working in the engineering industry and are lured away by fulltime employment, more money, and benefits. For the students that complete the Engineering Technology Program requirements, many

find employment immediately after graduation if they were not already employed in the field of engineering.

Very advanced computers are used to teach Computer Aided Drafting and Design (CADD) software. The computer hardware used in the program has to undergo continuous modifications and upgrades to meet software requirements. In 2004, AutoCAD grew into Autodesk with a larger offering of software packages. In addition, the software was being released perennially instead of on a biannual basis and the company no longer offered upgrades software packages, only complete software packages. In order to save money, the college entered into a lease agreement with Autodesk, which caused great concerns about perennially funding for the software. This step proved to be far less costly than the biannual purchase of the software and the program has benefited by offering many other Autodesk software applications to local industry. In 2015, Autodesk started offering its software free to educational institutions. The Engineering Technology Program began to expand down many different avenues. In addition to the Autodesk software packages (i.e. AutoCAD, Revit, Civil-3D, and InRoads), the program is also in a software lease agreement with the Bentley Systems Corporation for their software packages (i.e. MicroStation, GEOPAK, InRoads, etc.). This is an asset to the program as many State and Federal agencies utilize this software.

The program's state-of-the-art equipment was among the best in the state in 2007. A 3-D Prototype printer was added in the spring of 2005, and incorporated into courses in the fall of 2005. At that time the program also added another high tech piece of equipment, a Helix Laser. A year later, a contour cutter was added to the curriculum. However, these pieces of equipment have not been replaced or upgraded and according to the vendors, the equipment has surpassed their service life. Replacement parts and supplies are no longer manufactured for some of the equipment. More information is provided later in the program facilities and resources section.

Individuals enrolled in the program may earn an Associate of Applied Science Degree or a 9-month Credit Diploma Certificate. The Engineering Technology Program facilitates both degree and non-degree seeking, traditional and non-traditional students. The Engineering Technology Program provides students the opportunity and means to enter the workforce in the local engineering industry. In addition, the program can and has prepared students for transfer to pursue a Baccalaureate at many four-year institutions (mainly the University of Wyoming). Many students from the program decided to further their education at a four-year institution while the remaining graduates elect for employment.

Currently the Engineering Technology Program is in the initial stages of integrating an Architectural Building Science Degree Program and a Manufacturing Design Credit Diploma. The Engineering Technology Program successfully implemented the Construction Management Program in the fall of 2015. These additional options will allow Wyoming High School graduates the opportunity to use the Hathaway Scholarship at LCCC since no other Wyoming Colleges offer some of these options.

Students are satisfied with their course work leading to a Credit Diploma Certificate or an Associate of Applied Science Degree in Engineering Technology. Because the current program of study is small, students enjoy personal instruction and attention when working on design projects. The average course success rate for this review cycle is 89.7%. The Engineering Technology Program has an excellent reputation in supporting the local engineering industry and has a strong collaboration and articulation with local high schools. As technology continually advances in the various fields of engineering, there are numerous opportunities for the Engineering Technology Program to grow

## B. Program Achievements Over the Review Period

The Engineering Technology Program has had numerous achievements over the past five years at the program level.

Program Achievements:

- Faculty have streamlined the curriculum to better serve students.
- To meet the needs of the local and diverse engineering fields, the instructor of Engineering Technology worked with the Program's Advisory Committee to develop the curriculum as well as course offerings.
- The Engineering Technology Program underwent revision to modify the number of credit hours from 67 to 63.
- MCORs for all Engineering Technology courses have been developed and are up for approval.
- The Engineering Technology Program streamlined prerequisites so that students can more easily achieve graduation with a 2yr period and more easily allow professionals to enroll in courses to update skills.
- The Engineering Technology instructor, along with industry leaders from the field of construction created and developed the Construction Management Program. The college is now offering courses in Construction Management.

## C. Mission and Values

MISSION:

The Department of Engineering Technology prepares qualified professionals for entry-level technical positions in industry, business, and government. The department further seeks to deliver this educational opportunity via traditional and non-traditional modes of instruction. The mission of the Engineering Technology Program is to provide opportunities for all students, regardless of age, educational, societal, or cultural background, and aid students in achieving their educational goals in the areas of Architecture, Engineering, Construction (AEC), and Manufacturing technology. The program provides comprehensive, quality technical education that prepares students for careers in AEC as well as Manufacturing technologies. The program provides employers and the public of southeastern Wyoming with educated, technologically savvy graduates, able to serve the varied AEC industry needs as well as Manufacturing needs.

The program's mission of training engineering technicians for skilled jobs flows directly from the college's 2017-2018 catalog mission statement, which states "Laramie County Community College is to transform our students' lives through the power of inspired learning". The Engineering Technology Program aids in the transformation of its students' lives by offering authentic diverse educational experiences designed to be inspirational and engage in the continual life learning process. The program establishes this by:

- Preparing students to succeed academically in college-level learning environment
- Engaging students in learning activities that will prepare students for entry level positions or aid them in the pursuit of a baccalaureate degree
- Developing students to enter or advance in productive, life-fulfilling occupations and professions
- Enriching the community through activities that stimulate and sustain a healthy society and economy

## VALUES:

The Engineering Technology Program supports the mission of the college by being committed to the following values:

- Excellence in Instruction: The Engineering Technology Program believes in excellent instruction and achieves this by:
  - Continuous improvement
  - Enhancing student learning through innovative instructional methods.
  - Providing students with the tools to work in continuous improvement and learning beyond graduation to become lifelong learners
  - Providing an atmosphere where faculty committed to learning, discovery and engagement are free to investigate, apply and transfer knowledge.
  - Keeping state-of-the-art equipment and laboratories conducive toward discovery and application of new technologies
  - Encouraging students to become model citizens with strong sense of ethics and duty
  - Pursue excellence in every activity
  
- Service to Students: The Engineering Technology Program provides a high level of service to students and achieves this by:
  - Being available to students for assistance or advising.
  - Ensuring students that students get assistance in making connections with LCCC student services and systems that will aid in their success.
  - Collaborating with local engineering industry to provide future opportunities for LCCC students.

## D. Program Competencies and Outcomes

### a) Program level learning competencies:

The Engineering Technology Program is committed to the Accrediting Board for Engineering Technology (ABET) criteria, which reflect the knowledge, characteristics, and performance, that engineering technicians must have in order to succeed in the diverse field of engineering. The criteria are a clear set of competencies that are relevant across the various engineering industries and disciplines. These main competencies are recognized nationally for engineering programs. The Engineering Technology Program Competencies are outlined below with the respective ABET competencies.

Program Level Competencies that align with ABET Criteria:

1. Students interpret tests and measurements to analyze and solve narrowly defined engineering technology problems by applying principles and procedures or methodologies. (Align with ABET Criteria b & f)
2. Students design systems, components, or processes to solve broadly defined engineering problems. (Align with ABET Criteria c, d, & k)
3. Students apply mathematics, science, and engineering concepts with modern technological tools to solve engineering problems. (Align with ABET Criteria a)

#### ABET Criteria:

- a) an appropriate mastery of the knowledge, techniques, skills and modern tools of their discipline
- b) an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology
- c) an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes
- d) an ability to creativity to design systems, components and processes appropriate to program objectives
- e) an ability to function effectively on teams
- f) an ability to identify, analyze and solve technical problems
- g) an ability to communicate effectively
- h) a recognition of the need for, and an ability to engage in lifelong learning
- i) an ability to understand professional, ethical and social responsibilities
- j) a respect for diversity and a knowledge of contemporary professional, societal and global issues, and
- k) a commitment to quality, timeliness, and continuous improvement.

#### **b) Program competency that aligns with program values:**

Example of program competency that aligns with program values (1.C2): Competency #3 “Students apply mathematics, science, and engineering concepts with modern technological tools to solve engineering problems” align with the program value of Keeping state-of-the-art equipment and laboratories conducive toward discovery and application of new technologies. This is why it is imperative the Engineering Technology program keep abreast of the advancement of technology and employ up-to-date equipment in the curriculum.

#### **c) Program operational outcomes align with program values:**

1. Increase the number of majors by implementing recruitment strategies.
2. Increase persistence in the Engineering Technology Program by implementing semester-to-semester monitoring strategies.
3. Increase graduation rates by implementing degree completion strategies

Example of operational outcome that aligns with the program’s values (1.C.2): Outcome #3 “Increase graduation rates by implementing degree completion strategies” aligns with the value of “Service to Students.” This ensures that students get assistance in making connections with LCCC student services and systems that will aid in their success.

### **E. Abbreviated Summary of Program Data (KPIs)**

#### **Program Demand:**

The program performed at the middle range for the number of participants enrolled with a three-year average at 110, but realized a low three-year average for annual FTE at 22 and a low three-year average for the number of concentrators enrolled at 45. It is likely that many of the participants may be professionals from industry developing and updating technological skills, and they are not classified as completers. Effective tracking, marketing, and communicating with participants will be a priority for the department in the future.

#### **Student Success:**

The program realized a strong performance for graduation rate of concentrators at a three-year average of 64% and also performed well at course success rates with a three-year average of 88%. A lower area of performance was the number of degrees/certificates awarded with a three-year average of 7.

Currently it is difficult for the program to retain students after they obtain a job in the industry. The program has set a goal to increase this number.

**Transfer Preparation:**

The program performed at the low range for university matriculation rate with a three-year average of 14%. Currently the Engineering Technology Program is an Associate of Applied Science Program and has no articulation with any 4-yr institution.

**Efficiency:**

The program performed well in this category for average credits to completion with a three-year average of 60 credits and a three-year average for time to completion at 3 semesters. It operated at the middle range for core expenditures per FTE with a three-year average of \$4,451. However, it performed at the low range for the average section fill rate with a three-year average of 50%. This fill rate data appear skewed given that the capacity of the CADD Lab is just 12 students due to the limited amount of area, computer stations, and equipment. Currently it is believed that the current class cap amounts are set at a higher level than the CADD lab can hold.

## F. Accomplishing the Program's Previous Action Plan Goals

During the previous Engineering Technology Program review cycle, the Program established the following goals:

- To offer a nine-month certificate or an Associate of Applied Science degree to students in the Engineering Technology program.
- To provide training to drafting technicians who need to enhance their skills and to community members who want to achieve their own personal objectives.
- To prepare the program's graduates for immediate employment in technician-level occupations in engineering, manufacturing, construction, government, management, estimating and related occupations.
- To cooperate and collaborate with the engineering community in order to improve the program curricula.

### EVALUATION of GOALS

The Engineering Technology Program was successful in achieving these the established goals. The Program presently offers a nine-month Credit Diploma as well as an Associate of Applied Science Degree.

The Program has offered specialized training classes for the engineering industry as well as class availability for numerous professionals to update and enhance their skills. MCOR prerequisites were updated to list "instructor approval" in order for professionals from industry to register for Engineering Technology courses. In addition, there were members from the community that came in and designed their own house, detach garage, warehouse, and site plan for city approval.

The Program has prepared many graduates over the past review cycle and most of the graduates attained positions in the engineering industry while the rest continued their education to earn a 4yr degree from a university.

The Engineering Technology Program has successfully worked with the engineering community and the Program's Advisory Committee to improve the programs curricula.

In examining the goals established by the Program for the last review cycle, all were successfully accomplished. While these goals were accomplished, the Engineering Technology Program will continue to monitor and maintain then while beginning to work on the next set of program goals.

## G. Summary of Review Action Plan Goals

The Engineering Technology employs the engineering design cycle process of Identify, Plan, Do, Review, and Revise to resolve any issues.

### a). Based on the program review and action plan process, the following issues were identified,

- i) Initiate a yearlong recruiting campaign with the goal of increasing enrollment by 8% during the fall 2018 semester over the previous academic year.
- ii) Initiate articulation agreements with Metropolitan State University, or another 4yr institution, for graduates to continue their education to earn a baccalaureate degree.
- iii) Continue to investigate the need for a Manufacturing & Design Credit Diploma as well as an Architectural Building Science Program.
- iv) Design and implement course improvement strategies for courses that have a course success rate of under 80%, ENTK 1560 Freehand Sketching, Inking, and Rendering for Drafting & ENTK 2580 Microstation. These courses should see a 5% improvement in the 2018-2019 academic year over the previous year.
- v) Continue to develop and improve course and program mapping for the Engineering Technology Program.

### b) Planning goals as a result of discoveries:

These issues were identified by two main sources. Items i & ii were discovered by the Engineering Technology Advisory Committee as they reviewed program information. The Advisory Committee indicated that increasing enrollment is of high priority. As the local economy and business, increase industry will need skilled and technologically savvy personnel to help meet that demand. The Advisory Committee also thought it was important to build a bridge between the Engineering Technology Program and a 4yr institution. And given the Engineering Technology Advisory Committee consists of many diverse fields of engineering, members of the manufacturing and architectural field believed it would be beneficial for Wyoming industry as well for future students to develop and implement a Credit Diploma for Manufacturing and Design and a program for an Architectural Building Science degree. Items iv and v were discovered reviewing program data in the Aquila assessment process. Based on the discovery of institutional data, issues were identified and feedback along with guidance was provided by the Engineering Technology Advisory Committee. An Action Plan addressing student recruitment has been developed and posted in Aquila and is currently being implemented. At this point the program is waiting to examine results and revise the implemented plans.

#### Goal One:

Initiate a yearlong recruiting campaign with the goal of increasing enrollment by 8% during the fall 2019 semester over the previous academic year.

## H. Identified Strengths, Concerns, Opportunities, and Challenges for Student Learning and Program Operations Resulting from the Review Process

### a) Programs provide a bullet listing of its strengths, concerns, opportunities, and challenges for student learning.

#### Strengths:

- Small classes that provide personal instruction from a highly qualified instructor.
- Graduates are well prepared to enter the workforce or pursue a baccalaureate degree in a building science field.
- In 2015, successfully implemented a full curriculum redesign for the Engineering Technology Program and implemented program and course mapping to align course objectives with assignments.
- A recently modified curriculum, which eliminated three credits and several prerequisites in an effort to allow students to more easily achieve graduation within a two-year period as well as allow community members and local industry access to courses.

#### Concerns:

- Limited classroom space.
- The utilization of newer technologies in the curriculum. Technology has advanced significantly over the past 12 years, which was when the Engineering Technology Program received its last significant technological piece of equipment. As institutional budgets decline, the Engineering Technology Program may lose its ability to prepare graduates for the technological tools used every day in the fields of engineering. Because the program does not update its technological equipment on a regular basis, it may also lose its ability to recruit future students.

#### Opportunities:

- The Engineering Technology Program is committed to developing an articulation with a quality four-year institution to allow graduates to continue their education towards a baccalaureate degree if that is their desire.
- While student success numbers are relatively high across the program, there is significant room to improve and continually develop courses for better results that deliver more industry knowledge. This has been identified in the action plan and will be focused on for the next program review cycle.

#### Challenges:

- Computer hardware limitations to accommodate software that continually advances.
- Professional development in the newer technologies as well as the software.
- Students being hired by industry and leaving college prior to completing requirements for graduation.
- The Engineering Technology discipline being known as a very demanding, challenging, and tedious program of study.

**b) Programs provide a bullet listing of its strengths, concerns, opportunities, and challenges for program operations.**

**Strengths:**

- Curriculum is based on goals outlined by the Accreditation Board of Engineering and Technology.
- The Engineering Technology Program has an excellent reputation in supporting WYDOT along with a large proportion of the engineering industry in southeast Wyoming.
- A program mission that aligns with the college mission, goals, and strategic plan.
- A history of working with the program's Advisory Committee along with external stakeholders and acting to the best of its ability to implement their recommendations.

**Concerns:**

- Limited time to visit high schools to recruit. The instructor of the program has to double his efforts to recruit more on his own for both internal and external to the college. The instructor will have to learn to balance recruiting with the other demands of the Engineering Technology Program. This is of such high priority that it has been included as one of the program's major action plans.
- Aging Technological Equipment that consumes a large amount of time for the instructor to perform maintenance.
- There seems to be a lack of program marketing for several years. A number of students indicated that they discovered the program by accident.
- Continual cost of maintaining equipment, and concern for funding and replacing existing equipment.

**Opportunities:**

- Continuous program evaluation to meet industry and community need.
- Continue to work with the Wyoming Chapter of American Institute of Architects to implement the Architectural Building Science Program.
- Continue to develop the Manufacturing and Design Credit Diploma.
- Upgrade software and hardware requirements to meet industry needs
- Continue to expand partnerships with local engineering firms and allied fields.
- Develop an articulation agreement with Metropolitan State University Denver to build a 2+2+2 Career Path for students to seamlessly transition from high school to university.

**Challenges:**

- Students are training on 12-year-old technological equipment that has become outdated in the manufacturing field.
- Limited resources to obtain high cost supplies for courses.
- No clear institutional strategy to market the Engineering Technology Program.
- No recent equipment investment in the Engineering Technology Program by the institution.

**I. Continuous Improvement: Follow-Up Reporting and Planning for Strengthening Program Performance**

To be consistent with its continuous improvement processes, LCCC includes follow-up action planning in its academic program review activities. Program review includes a peer-review step where an Academic

Standards Subcommittee for Program Review rates program performance using an Academic Program Review Rubric. Programs perform well on the majority of self-study sections, but occasionally the rubric rating identifies a few areas that need additional attention. For these situations, the program review process includes a structured follow-up planning phase to support program strengthening of these areas.

In early May, after programs have had their self-studies peer reviewed, the Academic Standards Committee notifies those programs that are to participate in additional continuous improvement planning. Academic Standards accepted the Engineering Technology program review contingent on its development of additional follow-up action planning. Programs for the 2017-18 cycle begin developing their follow-up action planning in January 2019.