Institutional Effectiveness Report
2019-20

Program: Manufacturing & Engineering Technology BS

College and Department: College of Engineering – Manufacturing & Engineering Technology

Contact: Dale Wilson

Mission: To graduate innovative Technologists or Applied Engineers who solve technological challenges to meet societal needs.

The BSET program at TTU is a traditional on-campus lecture/laboratory program with on-ground course delivery offered almost exclusively during the day. There currently are no distance learning courses offered by the Manufacturing and Engineering Technology Department. A co-op program is available through the TTU Office of Career Services as an optional (but popular) choice.

Program Goals:

Graduates of the B.S. in Engineering Technology (ET) Program will

1. attain and succeed in positions related to Mechatronics Engineering Technology and Engineering Technology Management;

2. advance their careers and continue their professional development by pursuing graduate studies, attending workshops, obtaining certification and joining professional organizations;

3. succeed as leaders and managers in areas such as foundry operations, additive manufacturing, robotics, and industrial

Student Learning Outcomes

1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline;

2. An ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline;

3. An ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;

4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes, and

5. An ability to function effectively as a member as well as a leader on technical teams.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Assessment Methods:

1. *Alumni Survey: Indirect Assessment Tool:* Historically, alumni surveys have been used for program assessments since the first National Association of Industrial Technology (NAIT) accreditation in 1982. The department has administered the assessment instruments, analyzed and summarized the data, and presented the summary to the faculty for discussions, suggestions, and identification of necessary actions. The format of the alumni survey, which has been recently updated, is designed to assess ETAC of ABET Student Outcomes (1)-(5) and provide information related to the Program Educational Objectives. The survey is conducted every three years to evaluate the professional growth of our graduates.

   The alumni survey employs a 5-point "agree/disagree" scale (1 to 5), which is later converted to a 0-4 level-of-attainment scale by simply subtracting 1 point.

2. *Co-op Employer Survey: Direct Assessment Tool*: Around one-fifth of MET students participate in co-ops or internships during their time at Tennessee Tech. For co-op jobs sponsored through the Tennessee Tech Office of Career Development, the co-op employers are required to complete a formal evaluation of the performance of each student at the end of each co-op semester. In addition, employers of College of Engineering students are asked to respond to additional assessment questions, some of which are related to Student Outcomes. Co-op surveys are a valuable source of feedback directly from employers of our students, providing insight into their performance in-process, i.e., before they graduate. The co-op employer survey employs a 5-point scale (1 to 5), which is then converted to the 0-4 level-of-attainment scale.

3. *External Assessment of Senior Projects: Direct Assessment Tool:* This assessment method was first introduced in Spring 2014 after the decision to pursue ETAC of ABET accreditation was made. The Manufacturing and Engineering Technology Advisory Board (METAB) members are used as external evaluators to assess the senior project presentations. A new evaluation form was developed for this purpose. The external evaluation of senior projects assessment tool uses the 0-4 level of attainment scale.

4. *Faculty Course Assessment Report (FCAR): Indirect Assessment Tool:* This assessment tool was added in Spring 2014 after the decision was made to pursue ETAC of ABET accreditation. This measurement tool provides an assessment of the level-of-attainment of the students in a class with regard to the course's instructional outcomes. The assessment is done by the course instructor at the completion of the course. Each of the instructional outcomes associated with a student outcome is scored on the faculty course assessment Report using a 0-4 level-of-attainment scale.

5. *Graduating Senior Exit Surveys/Interviews: Indirect Assessment Tool:* A written survey is one part of the Graduating Senior Exit Interview process. The Senior Exit Survey for the BSET program allows graduating seniors to provide feedback regarding the faculty, the department, the career services, and their perceived attainment of the ETAC of ABET Student Outcomes. The Graduating Senior Exit Survey uses a 1-5 "satisfaction" scale, which is then converted to the 0-4 level-of-attainment scale. The second part of this survey process is that each graduating senior schedules an interview meeting with the department chair. In this confidential interview meeting, the chair discusses with the students their responses. The gathered information serves as a valuable source of suggestions for program improvement, as well as a source of supporting feedback on the student performance.

After receiving the feedback from the students, issues of particular or repeated concern are brought to the MET faculty for further discussion and possible action.

Expected Level of Attainment of the Student Outcomes

The expected level of attainment of the student outcomes is considered using the same 4-point scale used for the individual assessment tools.

4 = Excellent

3 = Good

2 = Satisfactory

1 = Low

0 = Negligible

Referring to the above scale, a score of 3.0 or above is a desirable score for each student outcome (1)-(5). A score between 2.0 and 3.0 is a cause for review by the MET faculty with possible action or continued monitoring. A score lower than 2.0 would require corrective action to be taken by the MET Faculty.

Results:

Student Outcome 1: Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline.

SO 1. Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline.						
Assessment Instrument	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**Fall 2019**	**Spring 2020**
Co-op Employer Survey	3.12	3.13	3.47	3.2	3.5	3.8
Faculty Course Assessment Reports					3.25	3.54
Course Term Project External Evaluation					3.5	3.8
Course-embedded Assessment					3.43	3.45
Senior Design Project					3.53	3.59
Senior Exit Survey						3.64
Alumni Survey						1.84

Assessment Data (Level of Attainment): 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible

Student Outcome 2: Design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline;

SO 2. Design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline;		
Assessment Instrument	**Fall 2019**	**Spring 2020**
Faculty Course Assessment Reports	3.29	3.29
Course Term Project External Evaluation	3.45	3.79
Course-embedded Assessment	3.12	3.39
Senior Design Project	3.37	3.45
Senior Exit Survey		3.09
Alumni Survey		1.53

Assessment Data (Level of Attainment): 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible

Student Outcome 3: Apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.

SO 3. Apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.						
Assessment Instrument	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**Fall 2019**	**Spring 2020**
Co-op Employer Survey	3.12	3.13	2.67	3.3	3.0	3.0
Faculty Course Assessment Reports					3.17	3.6
Course Term Project External Evaluation					3.28	3.69
Course-embedded Assessment					3.56	3.6
Senior Design Project					3.47	3.2
Senior Exit Survey						3.0
Alumni Survey						1.92

Assessment Data (Level of Attainment): 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible

Student Outcome 4: Conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes.

SO 4. Conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes.		
Assessment Instrument	**Fall 2019**	**Spring 2020**
Faculty Course Assessment Reports	3.0	3.0
Course-embedded Assessment	3.29	3.14
Senior Design Project	3.27	3.35
Senior Exit Survey		2.72
Alumni Survey		2.15

Assessment Data (Level of Attainment): 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible

Student Outcome 5: Function effectively as a member as well as a leader on technical teams.

SO 5. Function effectively as a member as well as a leader on technical teams.						
Assessment Instrument	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**Fall 2019**	**Spring 2020**
Co-op Employer Survey	3.4	3.73	3.47	3.76	3.75	3.0
Faculty Course Assessment Reports					3.33	4.0
Course Term Project External Evaluation					3.46	3.76
Course-embedded Assessment					3.75	3.74
Senior Design Project					3.34	3.45
Senior Exit Survey						3.45
Alumni Survey						1.92

Assessment Data (Level of Attainment): 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible

Modifications for Continuous Improvement

Alumni Survey results are generally lower on all SOs than the department would like. Significant changes to department staffing occurred in 2019-20 with the onboarding of a new interim department chair and two new instructors. One of these new instructors received 5 out of 5 on the IDEA course evaluation in the area of concern for the Alumni. Results from the recent Senior Exit Survey are positive and in time this positive trend should impact the Alumni Survey results.

SO 2: Alumni survey results indicated that students wanted experience with design systems for solving engineering problems. For 2020-21, SolidWorks training will be incorporated into MET3301 and Fusion 360 will be incorporated into MET3060. Both courses will include extra industrial case studies to provide practice with these tools.

SO 3: Alumni survey results fell below threshold for corrective action. Alumni perceive that written and oral communication is not being attained at the desired level. In response, MET has a plan to work with a communication instructor to improve technical communication/writing skills. The instructor will give several lectures for the students taking senior project (MET4620) course. Several courses (e.g., MET3403) will also include several lectures about how to write a technical report for improving students' writing skills.

Appendices

1. Curriculum Map

Appendix 1: Curriculum Map

Table 4.2b. Mapping of BSET Curriculum to the ETAC of ABET Student Outcomes

BSET Major Courses (Updated 5-14-2020)	SO 1	SO 2	SO 3	SO 4	SO 5
MET 1100 - Intro. To Manufacturing Engineering Tech.	X	X	X		
MET 2000 - Occupational Safety	X	X	X	X	
MET 2065 - Metal Manufacturing Technology	X	X			
MET 2310* - Applied Fluid Power	X	X	X		
MET 2400 - Statics and Strength of Materials	X	X	X	X	X
MET 2615 - Engineering Ethics and Professionalism	X	X	X		X
MET 3000 - Principles of Metal Casting		X		X	
MET 3100 - Applied Physical Metallurgy	X	X	X	X	
MET 3150 - Maintenance Technology 1	X	X	X		X
MET 3200 - Applied Electricity and Electronics	X	X			
MET 3301 - CAD for Technology		X●	X●		X●
MET 3403 - Applied Machine Elements	X	X	X	X	
MET 3700 - Manufacturing Cost Estimating	XX	X	X	X	
MET 3710 - Methods Design and Work Meas.	X	X	X	X	
MET 4310 - Plant Layout and Materials Handling		X●	X●		X●
MET 4620 - Senior Projects	X	X	X	X	X
Concentration I - Mechatronics Engr. Tech. 15 cr.					
MET 3060 - CNC Machining Practices (required)	X●	X●	X●		X●
MET 3260 - Industrial Electronics (required)	X	X	X		X
MET 4250 - Applied Mechatronics (required)	X	X	X		
MET 4000** - Advanced Foundry (elective)	X	X	X		X
MET 4210** - Programmable Logic Controllers (elective)	X	X	X		
MET 4220 - Ind. Automation and Robotics (elective)	X	X	X		
Concentration II - Engr. Tech. Mgmt. 15 cr.					
MET 4650 - Lean Six Sigma Mfg. (required)	X	X	X	X	
Select 4 courses from MET and Business elective courses					

*MET 2310 - Applied Fluid Power will not be offered any more from Fall 2020.
**MET 4000 - Advanced Foundry will be offered in Fall 2020.
**MET 4210 – Programmable Logic Controllers will be offered in Fall 2020.

X Courses address the student outcomes
Courses used for the FCAR
Courses used for Course-embedded Assessment
● Courses used for Course Term Project External Evaluation