Engineering Technology BSET

College of Engineering, Department of Manufacturing and Engineering Technology

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To graduate innovative Applied Engineers who solve technological challenges to meet societal needs.

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

- Indirect Assessment Tool: The survey is conducted every three years to evaluate the professional growth of our graduates. The alumni survey employs a 5-point "Outstanding/Unacceptable" scale (1 to 5), which is later converted to a 0-4 level-of-attainment scale by simply subtracting 1 point. To align with SLO 1, the survey asks the following question:

Based on your experiences while in our Manufacturing and Engineering Technology program, please rate how effectively you feel you were prepared in the following areas.

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.

- 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 "agree/disagree" scale, which is then converted to the 0-4 level-of-attainment scale. To align with SLO 1, the survey asks the following question:

Based on your experiences while in our Manufacturing and Engineering Technology program, please rate how effectively you feel you were prepared in the following areas.

> *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.*

– Indirect Assessment Tool: This assessment measures 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

(4.0), MET 4000 (4.0), MET4220 (3.66), MET4250 (3.33), MET2065 (4.0), MET3270 (4.0), MET4620(4.0); MET3200 (4.0), MET3403(4.0)

Course Term Project External Evaluation (15%): It indicated a level-of-attainment of "3.82".

Course-embedded Assessment: MET3060 was used. The overall response indicated a level-of-attainment of "2.90".

Senior Design Project: the overall responses indicated a level-of-attainment of "3.825".

Co-op Employers Survey: On the question of "Identifies, formulates and solves engineering problems", the BSET students scored "4.0."

A heavier weight was given to the direct assessment and lesser weights were given to the indirect assessment tools. Accordingly, weights were applied to get a weighted assessment of SO 3(5) of 10% of alumni survey, 10% of senior exit survey, 10% for the average FCAR score, 15% of course term project external evaluation, 15%ofcourse-embeddedassessment, 20% of the senior design project, and 20% of the Co-op report.

Overall attainment of Student Outcome 1 is 3.39 (Fall 2022) and 3.58 (Spring 2023). The results are above the threshold level of 3.0.

Newly conducted alumni survey presented substantial improvement results for Student Outcome 1 in Spring 2023.

In Spring 2023, the attainment level of Student Outcome 1 was low in course embedded assessment since the number of the course students was low compared to former semesters and

MET 4310 and MET4250

Course embedded Assessment - Direct Assessment Tool: Specific course level assessments (HW, Test, Project, Report) are taken and evaluated to measure the success rate of the course students for a specific ABET Student Outcome in Outcomes 1-5. Then the final score of the course embedded assessment is converted to 1-4 scale. To align with SLO 2, course embedded assessments are included in the following course:

MET 4620

– Direct Assessment Tool: Term projects prepared by the course students submit their reports, presentation materials, and project flyers. A team of external graduate students judge the quality of their works and presentations in terms of program outcomes. Graduate Students' Assessment of Course Term Projects tool uses the 1-10 level of attainment scale. Then, the averaged results are converted to 0-4 level-of-attainment scale. To align with SLO 2, the survey asks the following question:

Did the design meet the defined specifications of the project's problem?

- 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's Center for 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. To align with SLO 2, the survey asks the following question:

Displays an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems.

2 = Satisfactory (Any attainment between 2 and 3 will be monitored continuously)

1 = Low

0 = Negligible

Referring to the above scale, a score of 3.0 or above is a desirable score for each student

Justification for the level-of-attainment assigned to each Student Outcome in Table 2 is given in the following paragraphs.

Senior Design Project: MET4620	3.88	10
Senior Design Project: MET4620 (External)	3.75	10

Co-op Employers Survey

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

- Indirect Assessment Tool: The survey is conducted every three years to evaluate the professional growth of our graduates. The alumni survey employs a 5-point "Outstanding/Unacceptable" scale (1 to 5), which is later converted to a 0-4 level-of-

MET1115, MET2400, MET3150, MET3303, MET3703, MET3060, MET4310, MET4600, MET4220, MET4250, MET4620, MET3403

- Direct Assessment Tool: 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. To align with SLO 3, external evaluation is conducted in the following courses:

MET 3060 and MET 4310

- Direct Assessment Tool: Specific course level assessments (HW, Test, Project, Report) are taken and evaluated to measure the success rate of the course students for a specific ABET Student Outcome in Outcomes 1-5. Then the final score of the course embedded assessment is converted to 1-4 scale. To align with SLO 3, course embedded assessments are included in the following course:

MET 4620

– Direct Assessment Tool: Term projects prepared by the course students submit their reports, presentation materials, and project flyers. A team of external graduate students judge the quality of their works and presentations in terms of program outcomes. Graduate Students' Assessment of Course Term Projects tool uses the 1-10 level of attainment scale. Then, the averaged results are converted to 0-4 level

Demonstrates effective graphical communication for targeted audiences.

Each individual assessment tool contributes to the overall level of attainment for the SLO (Alumni survey 10%, Senior Exit Survey 10%, FCAR 10%, Course Term Project External

Course Term Project External Evaluation: MET3060 and MET 4310

	Faculty Course Assessment Reports: MET1115(4.0), MET2400(4.0), MET3150(4.0), MET3303(4.0), MET3703(4.0), MET3060(3.0), MET4310(3.0), MET4600(3.0), MET4220(3.0), MET4250(3.0), MET4620(4.0), MET3403(3.0)	3.17	10	
	Course Term Project External Evaluation: MET3060 and MET 4310	3.62	15	
	Course-embedded Assessment MET 3060	3.39	15	
	Senior Design Project: MET 4620	3.71	10	
	Senior Design Project: MET4620 (External)	3.64	10	
	Co-oP Employers Survey	2.63	20	

Justification for assigned levels-of-attainment of ABET student outcome 3 in Spring 2023:

Justification for the level-of-attainment assigned to each Student Outcome in Table is given in the following paragraphs.

Alumni Survey: It indicated a level of attainment of "3.06".
Senior Exit Survey: It indicated a level of attainment of "3.28".
*Faculty Course Assessment Reports: The average score (3.17) was obtained from*MET1115(4.0), MET2400(4.0), MET3150(4.0), MET3303(4.0), MET3703(4.0), MET3060(3.0), MET4310(3.0), MET4600(3.0), MET4220(3.0), MET4250(3.0), MET4620(4.0), MET3403(3.0)
Course Term Project External Evaluation: It indicated a level-of-attainment of "3.62".
Course-embedded Assessment: MET3060. The overall response indicated a level-of-attainment of "3.39".
Senior Design Project: On the question of "Message under Visual Aids" and "Verbal delivery under professionalism", the METAB responses indicated a level-of-attainment of "3.675".
Co-op Employers Survey: On the question of "Delivers effective oral presentation", the BSET students scored "2.63."
A heavier weight was given to the direct assessment and lesser weights were given to the indirect assessment tools. Accordingly, weights were applied to get a weighted assessment of SO 3(5) of 10% of alumni survey, 10% of senior exit survey, 10% for the average FCAR score, 15% of course term project external evaluation, 15%ofcourse-embeddedassessment, 20% of the senior design project, and 20% of the Co-op report.

Overall attainment of Student Outcome 1 is 3.08 in Fall 2022 and 3.09 in Spring 2023. The results are above the threshold level of 3.0.

In coop employer survey, the number of responses is two in Spring 2023. That is why the attainment of outcome 3 is low. The number of responses is one in Fall 2022. That is why the attainment of outcome 3 is low.

Ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes.

– Indirect Assessment Tool: This assessment measures 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. To align with SLO 4, FCAR evaluates the following courses:

MET 1115, MET2400, MET3303, MET3703, MET3003, MET3270, MET4620, MET3200, MET3403

– Direct Assessment Tool: Term projects prepared by the course students submit their reports, presentation materials, and project flyers. A team of external graduate students judge the quality of their works and presentations in terms of program outcomes. Graduate Students' Assessment of Course Term Projects tool uses the 1-10 level of attainment scale. Then, the averaged results are converted to 0-4 level-of-attainment scale. To align with SLO 4, the survey asks the following question:

Did the team conduct standard experiments and analysis to improve processes?

- 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's Center for 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. To align with SLO 4, the survey asks the following question:

Displays the ability to conduct standard tests, measurements, and experiments and to analyze the results to improve processes.

Each individual assessment tool contributes to the overall level of attainment for the SLO (Alumni survey 20%, Senior Exit Survey 20%, FCAR 10%, Senior Design Project 30%, and Co-op Employer Survey 20%). The expected level of attainment of the student learning outcome is considered using the same 4-point scale used for the individual assessment tools.

4 = Excellent

3 = Good (This is the threshold number)

2 = Satisfactory (Any attainment between 2 and 3 will be monitored continuously)

1 = Low

0 = Negligible

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

Conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes.

Results: Overall level of attainment of student outcome 4, based on the evaluation of the assessment data

Fall 2022

Student Outcome 4	Assessment Data (Level of Attainment) 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible	Level of Attainment	Weight	Overall Level of Attainment
Fall 2022	Alumni Survey	2.52	20%	2.99 (74.75%)
	Senior Exit Survey	3.41	20%	
	Faculty Course Assessment Reports: MET 1115(4.0), MET2400(4.0), MET3303(4.0), MET3703(4.0), MET3003(4.0), MET3270(3.0), MET4620(4.0), MET3200(4.0), MET3403(3.0)	3.78	10%	

Alumni Survey: It indicated a level of attainment of "2.86".
Senior Exit Survey: It indicated a level-of-attainment of "3.36".
Faculty Course Assessment Reports: The average score (3.78) was obtained from MET 1115(4.0), MET2400(4.0), MET3303(4.0), MET3703(4.0), MET3003(4.0), MET3270(3.0), MET4620(4.0), MET3200(4.0), MET3403(3.0).
Senior Design Project: On the question of "Technical content (analysis and support)", the responses indicated a level-of-attainment of "3.78".
A heavier weight was given to the direct assessment and lesser weights were given to the indirect assessment tools. Accordingly, weights were applied to get a weighted assessment of SO 3(4) of 20% for the alumni survey, 20% of the senior exit interview, 10% of average FCAR score, 20%of Coop Employers Survey, and 30% of the senior design project.

Overall attainment of Student Outcome 1 is 2.99 in Fall 2022 and 3.33 in Spring 2023. Dr. Vondra and Dr. Fidan have not been practicing/covering the student outcome 4 in their courses. Old days, Dr. Vondra was doing sand quality testing, measurement, and analysis. The attainment of Student Outcome 4 is getting tougher. Dr. Vondra is interested to allocate more budget to course instructors for the attainment of this outcome.

The department assessment committee suggested that Dr. Michael Baswell will pay more attention on student outcome 4 in his electricity and senior design courses.

There was a low number of coop survey responses. Response rate should be increased especially to collect more data for the Student Outcome 4.

In Spring 2023 Assessment Committee Meeting, it was

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

- Indirect Assessment Tool: The survey is conducted every three years to evaluate the professional growth of our graduates. The alumni survey employs a 5-point “Outstanding/Unacceptable” scale (1 to 5), which is later converted to a 0-4 level-of-attainment scale by simply subtracting 1 point. To align with SLO 5, the survey asks the following question:

Based on your experiences while in our Manufacturing and Engineering Technology program, please rate how effectively you feel you were prepared in the following areas.

Ability to function effectively as a member as well as a leader on technical teams.

- 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

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5), which is then converted to the 0-4 level-of-attainment scale. To align with SLO 5, the survey asks the following question:

Functions effectively as a member as well as a leader on technical teams.

Each individual assessment tool contributes to the overall level of attainment for the SLO

	Senior Exit Survey	3.71	10%	
	Faculty Course Assessment Reports: MET1115(4.0), MET3060(4.0), MET4310(4.0), MET4600(4.0), MET3270(3.0), MET4620(4.0)	3.83	10%	
	Course Term Project External Evaluation: MET3060 and MET 4310	3.88	15%	
	Course-embedded Assessment MET 4600 (3.47)	3.47	15%	
	Senior Design Project: MET 4620	3.62	20%	
	Co-op Employers Survey	4.00	20%	

Justification for assigned levels-of-attainment of ABET student outcome 5 in Fall 2022:

Justification for the level-of-attainment assigned to each Student Outcome in Table 5 is given in the following paragraphs.

Alumni Survey: It indicated a level of attainment of "2.34".
Senior Exit Survey: It indicated a level-of-attainment of "3.71".
Faculty Course Assessment Reports: The average score (3.83) was obtained from MET1115(4.0), MET3060(4.0), MET4310(4.0), MET4600(4.0), MET3270(3.0), MET4620(4.0)
Course Term Project External Evaluation: It indicated a level-of-attainment of "3.88".
Course-embedded Assessment: The term project of MET4600 was used. The overall response indicated a level-of-attainment of "3.47".
Senior Design Project: On the question of "Organization and team management", the METAB responses indicated a level-of-attainment of "3.62".
Co-op Employers Survey (10%): On the question of "Work effectively with other employees", the BSET students scored "4.00".
A heavier weight was given to the direct assessment and lesser weights were given to the indirect assessment tools. Accordingly, weights were applied to get a weighted assessment of SO 3(5) of 10% of alumni survey, 10% of senior exit survey, 10% for the

Spring 2023

Student Outcome 5	Assessment Data (Level of Attainment) 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible	Level of Attainment	Weight	Overall Level of Attainment
Spring 2023	Alumni Survey	3.37	10	3.42
	Senior Exit Survey	3.68	10	
	Faculty Course Assessment Reports: MET1115, MET3060, MET4310, MET4600, MET3270, MET4620	3.20	10	
	Course Term Project External Evaluation: MET3060 and MET 4310	3.77	15	
	Course-embedded Assessment MET 4600 (3.47)	3.68	15	
	Senior Design Project: MET 4620	3.89	10	
	Senior Design Project: MET4620 (External)	3.90	10	
	Co-op Employers Survey	3.75	20	

Justification for assigned levels-of-attainment of ABET student outcome 5 in Spring 2023:

Justification for the level-of-attainment assigned to each Student Outcome in Table 5 is given in the following paragraphs.

Alumni Survey: It indicated a level of attainment of "3.37".
Senior Exit Survey: It indicated a level-of-

average FCAR score, 15% of course term project externalevaluation, 15%ofcourse-embeddedassessment, 20% of the senior design project, and 20% of the Co-op report.

Overall attainment of Student Outcome 5 is 3.61 in Fall 2022 and 3.42 in Spring 2023.

There was a low number of coop survey responses. Response rate should be increased especially to collect more data for the Student Outcome 5.

In Spring 2023 Assessment Committee Meeting, it was decided to drop the Faculty Course Assessment Report (FCAR) and add its weighting to Course Embedded Assessment. The reason for this change was that the faculty was using the course grades to complete the FCAR reports every semester, and this wasn't reflecting the quality of attainment for each student outcome.

In the upcoming two semesters, one of the departmental faculty will be on leave for a year. Departmental adjuncts and instructors were trained about the importance of attaining the student outcome 5 via course lectures and laboratory practices.

It is evident that the achievement of all student learning outcomes is successfully accomplished, and the program did a good job in measuring the attainment level of these student outcomes with multiple assessment tools. Based on the current findings, the assessment committee will pay a special attention to 1) find ways to obtain more co-op evaluation reports of students who participate in coop program, 2) find ways to obtain more results from the course embedded assessment for the Student Learning Outcome 4, and 3) train the adjuncts and instructors with the successful attainment of our student outcomes since one the full time faculty members will be on leave for a year.

Departmental assessment committee decided to remove the Faculty Course Assessment Report (FCAR) from our assessment plan. Starting Fall 2023, FCAR will not be used as an assessment tool to measure the attainment of our student learning outcomes. The reason for this change

Appendix 1: Curriculum Map, Engineering Technology BSET