

Institutional Effectiveness
2023-2024

Program: Engineering Technology BSET

College and Department: College of Engineering, Department of Manufacturing and Engineering Technology

Contact: Dr. Ismail Fidan

Mission:

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

Attach Curriculum Map (Educational Programs Only):

Dr. Beth Powel, Ms. Pauline Nevins, Ms. Susan Cadle, and Dr. Ismail Fidan have developed the attached/latest MET curricular map. This one also shows the courses of newly developed concentration, Smart Manufacturing Engineering Technology.

Attached Files: See Appendix 1

SLO 1: FUNDAMENTALS: Apply knowledge, techniques, skills and modern tools of STEM

Define Outcome:

Student Learning 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.

Assessment Methods:

Alumni Survey - Indirect Assessment Tool: The survey is conducted every three years to evaluate the professional growth of our graduates. The University Advancement conducts this survey, which is sent to program graduates from the past five years. 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. To align with SLO 1, the survey asks the following question:

Based on your experiences while in our 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.

Senior Exit Survey - Indirect Assessment Tool: An online survey is one part of the Graduating Senior Exit Interview process. It is handed by the College of Engineering. 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 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.

Course Term Project External Evaluation - Direct Assessment Tool: The departmental graduate students and/or adjuncts are used as external evaluators to assess some of the technical courses' term project presentations. An evaluation form was developed for this purpose. The external evaluation of term projects' assessment tool uses a "0-10" scale which is then converted to the 0-4 level-of-attainment scale. To align with SLO 1, The survey asks the following question:

The student presents 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 through the term project presented today. YOUR ANSWER: 1-10 (1 is lowest, 10 is highest). Explain very briefly why you gave this grade.

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.

Senior Design Project – Direct Assessment Tool: Capstone projects, along with their mockups, posters, and presentations, are showcased to the METAB advisory board members and program faculty. The assessment tool employs a 1-5 level of attainment scale, which is then averaged and converted to a 0-4 scale. To align with SLO 1, the survey asks the following question to the METAB advisory board members and program faculty:

How well did the team use the foundational/applied knowledge and modern tools of STEM (Science, Technology, Engineering, and Math).

Co-op Employer Survey - Direct Assessment Tool: Few program students participate in the co-op program during their time at Tennessee Tech. For co-op jobs sponsored by Tennessee Tech, employers are required to complete a formal evaluation of each student's performance at the end of each co-op semester. Additionally, employers of College of Engineering students are asked to respond to further assessment questions, some of which pertain to Student Outcomes. Co-op surveys provide valuable feedback directly from employers, offering insights into students' performance before graduation. The co-op employer survey uses a 5-point scale (1 to 5), which is then converted to a 0-4 level-of-attainment scale. To align with SLO 1, the survey asks the following question:

Applies knowledge, techniques, skills, and modern tools of math, science, engineering, and technology to solve broadly-defined engineering problems.

Criteria for Success (Thresholds for Assessment Methods):

Each individual assessment tool contributes to the overall level of attainment for the SLO (Alumni survey 10%, Senior Exit Survey 10%, Course Term Project External Evaluation 15%, Course-embedded Assessment 25%, Senior Design Project 20%, and Co-op Employer Survey 20%). The expected level of attainment of the SLO 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.

Link to 'Tech Tomorrow' Strategic Plan:

1.A Experiential Learning, 2.A Technology Infused Programs

Results and Analysis:

SLO 1: FUNDAMENTAL - Apply knowledge, techniques and skills

Overall level of attainment of student outcome 1, based on the evaluation of the assessment data.

FALL 2023

| Student Outcome 1 | Assessment Data (Level of Attainment) 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible | Level of Attainment | Weight (%) | Overall Level of Attainment |
|-------------------|--|---------------------|------------|-----------------------------|
| Fall 2023 | Alumni Survey | 3.27 | 10 | 3.63 (90.81%) |
| | Senior Exit Interview | 3.71 | 10 | |
| | COOP | 4 | 20 | |
| | Term Project | 3.6 | 15 | |
| | Course-embedded Assessment | 3.45 | 25 | |
| | Senior Design Project: MET4620 | 3.66 | 20 | |

Justification for assigned levels-of-attainment of student outcome 1 in Fall 2023:

- The attainment of SO1 in Fall 2023 is “3.63”, indicating that the ET students attain the SO1.
- As evidence, in MET3060, the course has shown a high level of attainment in SO1 homework and lab practices to understand the foundation of G and M coding. Using Fusion 360 as a simulation tool help the student grasp contents and implementing industrial practices.
- As initial evidence, in MET3200, the test on mathematics for calculating resistances, powers and in circuits and finding gain in amplifiers.
- MET invested \$20,000 for Electricity Lab enhancement.
- ATC donated \$300,000 laser welding machine to MET.
- Tutco donated \$3,500 for wiring station for senior project.
- Herrick foundation donated \$150,000 for a new power supply in foundry.
- Capstone project evaluations are revised to shorten the feedback and received factual outcomes from advisory board and faculty.
- Faculty developed more opened educational resources to increase the online deliverable of curriculum courses (e.g., MET3150 and MET4600).
- MET2065 reorganization to allow an instructor to be closer to the students during the labs.

SPRING 2024

| Student Outcome 1 | Assessment Data (Level of Attainment) 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible | Level of Attainment | Weight (%) | Overall Level of Attainment |
|-------------------|--|---------------------|------------|-----------------------------|
| Spring 2024 | Alumni Survey | 3.27 | 10 | 3.43 (85.85%) |
| | Senior Exit Interview | 3.44 | 10 | |
| | COOP | 2.93 | 20 | |
| | Term Project | 3.52 | 15 | |
| | Course-embedded Assessment | 3.65 | 25 | |
| | Senior Design Project: MET4620 | 3.68 | 20 | |

Justification for assigned levels-of-attainment of student outcome 1 in Spring 2024:

- The attainment of SO1 in Spring 2024 is “3.43”, indicating that ET students show that they attain the SO1.
- As evidence, in MET3060, the course has shown a high level of attainment in SO1 homework and lab practices to understand the foundation of G and M coding. Using Fusion 360 as a simulation tool help the student grasp contents and implementing industrial practices.
- As initial evidence, in MET3200, the test on mathematics for calculating resistances, powers and in circuits and finding gain in amplifiers.
- Faculty developed more opened educational resources to increase the online deliverable of curriculum courses (e.g., MET3150 and MET4600).
- MET2065 reorganization to allow an instructor to be closer to the students during the labs.

Attached Files: See Appendix 2

Use of Results to Improve Outcomes:

Tutoring via Student Success Center and University level teaching support for almost allSTEM courses helps student to be more successful.

More courses are able to prototype their term and class projects using the department and iMakerSpaces facilities.

Approved to hire two new faculty for MET.

Smart manufacturing engineering technology concentration is proposed to approve.

Attached Files: See Appendix 2

SLO 2: DESIGN: Design systems, components, or processes

Define Outcome:

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

Assessment Methods:

Alumni Survey - Indirect Assessment Tool: The survey is conducted every three years to evaluate the professional growth of our graduates. The University Advancement conducts this survey, which is sent to program graduates from the past five years. 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. To align with SLO 1, the survey asks the following question:

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

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

Senior Exit Survey - Indirect Assessment Tool: An online survey is one part of the Graduating Senior Exit Interview process. It is handed by the College of Engineering. 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 Engineering Technology program, please rate how effectively you feel you were prepared in the following areas.

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

Course Term Project External Evaluation - Direct Assessment Tool: The departmental graduate students and/or adjuncts are used as external evaluators to assess some of the technical courses' term project presentations. An evaluation form was developed for this purpose. The external evaluation of term projects' assessment tool uses a "0-10" scale which is then

converted to the 0-4 level-of-attainment scale. To align with SLO 1, The survey asks the following question:

The student presents an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline throughout the term project presented today. YOUR ANSWER: 1-10 (1 is lowest, 10 is highest). Explain very briefly why you gave this grade.

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.

Senior Design Project – Direct Assessment Tool: Capstone projects, along with their mockups, posters, and presentations, are showcased to the METAB advisory board members and program faculty. The assessment tool employs a 1-5 level of attainment scale, which is then averaged and converted to a 0-4 scale. To align with SLO 1, the survey asks the following question to the METAB advisory board members and program faculty:

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

Co-op Employer Survey - Direct Assessment Tool: Few program students participate in the co-op program during their time at Tennessee Tech. For co-op jobs sponsored by Tennessee Tech, employers are required to complete a formal evaluation of each student's performance at the end of each co-op semester. Additionally, employers of College of Engineering students are asked to respond to further assessment questions, some of which pertain to Student Outcomes. Co-op surveys provide valuable feedback directly from employers, offering insights into students' performance before graduation. The co-op employer survey uses a 5-point scale (1 to 5), which is then converted to a 0-4 level-of-attainment scale. To align with SLO 1, the survey asks the following question:

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

Criteria for Success (Thresholds for Assessment Methods):

Each individual assessment tool contributes to the overall level of attainment for the SLO (Alumni survey 10%, Senior Exit Survey 10%, Course Term Project External Evaluation 15%, Course-embedded Assessment 25%, Senior Design Project 20%, and Co-op Employer Survey 20%). The expected level of attainment of the SLO 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.

Link to 'Tech Tomorrow' Strategic Plan:

1.A Experiential Learning, 2.A Technology Infused Programs

Results and Analysis:

SLO 2: DESIGN - Design systems, components, or processes

Overall level of attainment of student outcome 2, based on the evaluation of the assessment data.

Fall 2023

| Student Outcome 2 | Assessment Data (Level of Attainment) 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible | Level of Attainment | Weight (%) | Overall Level of Attainment |
|-------------------|--|---------------------|------------|-----------------------------|
| Fall 2023 | Alumni Survey | 3.18 | 10 | 3.53 (88.26%) |
| | Senior Exit Interview | 3.66 | 10 | |
| | COOP | 3.2 | 20 | |
| | Term Project | 3.8 | 15 | |
| | Course-embedded Assessment | 3.65 | 25 | |
| | Senior Design Project: MET4620 | 3.62 | 20 | |

Justification for assigned levels-of-attainment of ABET student outcome 2 in Fall 2023:

- The attainment of SO2 in Fall 2023 is “3.53”, indicating that students can apply components of SO2.
- Many computers in LEWS101 were upgraded.

- CAD for Technology course was offered by an industrial expert who has a PhD and industrial design skills.
- iMakerSpace offered a design team to support the students.

Spring 2024

| Student Outcome 2 | Assessment Data (Level of Attainment) 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible | Level of Attainment | Weight (%) | Overall Level of Attainment |
|-------------------|--|---------------------|------------|-----------------------------|
| Spring 2024 | Alumni Survey | 3.18 | 10 | 3.36 (84.05%) |
| | Senior Exit Interview | 3.31 | 10 | |
| | COOP | 2.67 | 20 | |
| | Term Project | 3.70 | 15 | |
| | Course-embedded Assessment | 3.62 | 25 | |
| | Senior Design Project: MET4620 | 3.61 | 20 | |

Justification for assigned levels-of-attainment of ABET student outcome 2 in Spring 2024:

- The attainment of SO2 in Spring 2024 is “3.36”, indicating that students can apply components of SO2.
- Same findings as given above.

Attached Files: See Appendix 3

Use of Results to Improve Outcomes:

- More upgrades to Computers in LEWS101.
- More design practices in Plant Layout course.
- Bringing adjunct with industrial CAD skills.
- More collaborations and getting support from iMakerSpace.

Attached Files: See Appendix 3

SLO 3: COMMUNICATION: Apply written, oral, and graphical communication

Define Outcome:

Student Learning 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.

Assessment Methods:

Alumni Survey - Indirect Assessment Tool: The survey is conducted every three years to evaluate the professional growth of our graduates. The University Advancement conducts this survey, which is sent to program graduates from the past five years. 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. To align with SLO 1, the survey asks the following question:

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

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.

Senior Exit Survey - Indirect Assessment Tool: An online survey is one part of the Graduating Senior Exit Interview process. It is handed by the College of Engineering. 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 Engineering Technology program, please rate how effectively you feel you were prepared in the following areas.

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.

Course Term Project External Evaluation - Direct Assessment Tool: The departmental graduate students and/or adjuncts are used as external evaluators to assess some of the technical courses' term project presentations. An evaluation form was developed for this purpose. The external evaluation of term projects' assessment tool uses a "0-10" scale which is then converted to the 0-4 level-of-attainment scale. To align with SLO 1, The survey asks the following question:

The student presents 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 throughout the term project presented today. YOUR ANSWER: 1-10 (1 is lowest, 10 is highest). Explain very briefly why you gave this grade.

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.

Senior Design Project – Direct Assessment Tool: Capstone projects, along with their mockups, posters, and presentations, are showcased to the METAB advisory board members and program faculty. The assessment tool employs a 1-5 level of attainment scale, which is then averaged and converted to a 0-4 scale. To align with SLO 1, the survey asks the following question to the METAB advisory board members and program faculty:

Did the team effectively present the project with technical literature?

Co-op Employer Survey - Direct Assessment Tool: Few program students participate in the co-op program during their time at Tennessee Tech. For co-op jobs sponsored by Tennessee Tech, employers are required to complete a formal evaluation of each student's performance at the end of each co-op semester. Additionally, employers of College of Engineering students are asked to respond to further assessment questions, some of which pertain to Student Outcomes. Co-op surveys provide valuable feedback directly from employers, offering insights into students' performance before graduation. The co-op employer survey uses a 5-point scale (1 to 5), which is then converted to a 0-4 level-of-attainment scale. To align with SLO 1, the survey asks the following question:

Produces effective written communications to targeted audiences.

Produces effective oral presentations to targeted audiences.

Demonstrates effective graphical communication for targeted audiences.

Criteria for Success (Thresholds for Assessment Methods):

Each individual assessment tool contributes to the overall level of attainment for the SLO (Alumni survey 10%, Senior Exit Survey 10%, Course Term Project External Evaluation 15%, Course-embedded Assessment 25%, Senior Design Project 20%, and Co-op Employer Survey 20%). The expected level of attainment of the SLO 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.

Link to 'Tech Tomorrow' Strategic Plan:

1.A Experiential Learning, 2.A Technology Infused Programs

Results and Analysis:

SLO 3: COMMUNICATION - Apply written, oral, and graphical communication

Overall level of attainment of student outcome 3, based on the evaluation of the assessment data.

Fall 2023

| Student Outcome 3 | Assessment Data (Level of Attainment) 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible | Level of Attainment | Weight (%) | Overall Level of Attainment |
|-------------------|--|---------------------|------------|-----------------------------|
| Fall 2023 | Alumni Survey | 3.25 | 10 | 3.50 (87.60%) |
| | Senior Exit Interview | 3.41 | 10 | |
| | COOP | 3.6 | 20 | |
| | Term Project | 4 | 15 | |

| | | | | |
|--|--------------------------------|------|----|--|
| | Course-embedded Assessment | 3.24 | 25 | |
| | Senior Design Project: MET4620 | 3.54 | 20 | |

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

- The attainment of SO3 in Fall 2023 is “3.50”, indicating that students can apply components of SO3.
- Capstone project evaluations are revised to shorten the feedback and received factual outcomes from advisory board and faculty.
- Faculty developed more opened educational resources to increase the online deliverable of curriculum courses (e.g., MET3150 and MET4600).
- Support received from the Student Success Center and Career Development Center.
- Several courses from Freshman to Senior level help students engage and practice communication skills.
- Faculty provides support to students’ writing and speech development.

Spring 2024

| Student Outcome 3 | Assessment Data (Level of Attainment) 4 = Excellent; 3 = Good; 2 = Satisfactory; 1 = Low; 0 = Negligible | Level of Attainment | Weight (%) | Overall Level of Attainment |
|-------------------|--|---------------------|------------|-----------------------------|
| Spring 2024 | Alumni Survey | 3.25 | 10 | 3.48 (87.10%) |
| | Senior Exit Interview | 3.47 | 10 | |
| | COOP | 3.07 | 20 | |
| | Term Project | 3.60 | 15 | |
| | Course-embedded Assessment | 3.74 | 25 | |
| | Senior Design Project: MET4620 | 3.62 | 20 | |

Justification for assigned levels-of-attainment of ABET student outcome 3 in Spring 2024:

- The attainment of SO3 in Spring 2024 is “3.48”, indicating that students can apply components of SO3.
- Same as given above.

Attached Files: See Appendix 4

Use of Results to Improve Outcomes:

- ET Students get support from faculty to improve their communication skills.
- University and CoE provide support to enhance students' communication skills.
- Use of term projects and their professional oral and written presentation are encouraged.
- Participation of students in Research and Inquiry Day is encouraged.

Attached Files: See Appendix 4

SLO 4: ANALYSIS: Conduct standard tests, measurements, and experiments and analyze the results

Define Outcome:

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

Assessment Methods:

Alumni Survey - Indirect Assessment Tool: The survey is conducted every three years to evaluate the professional growth of our graduates. The University Advancement conducts this survey, which is sent to program graduates from the past five years. 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. To align with SLO 1, the survey asks the following question:

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

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

Senior Exit Survey - Indirect Assessment Tool: An online survey is one part of the Graduating Senior Exit Interview process. It is handed by the College of Engineering. 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 Engineering Technology program, please rate how effectively you feel you were prepared in the following areas.

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

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.

Senior Design Project – Direct Assessment Tool: Capstone projects, along with their mockups, posters, and presentations, are showcased to the METAB advisory board members and program faculty. The assessment tool employs a 1-5 level of attainment scale, which is then averaged and converted to a 0-4 scale. To align with SLO 1, the survey asks the following question to the METAB advisory board members and program faculty:

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

Co-op Employer Survey - Direct Assessment Tool: Few program students participate in the co-op program during their time at Tennessee Tech. For co-op jobs sponsored by Tennessee Tech, employers are required to complete a formal evaluation of each student's performance at the end of each co-op semester. Additionally, employers of College of Engineering students are asked to respond to further assessment questions, some of which pertain to Student Outcomes. Co-op surveys provide valuable feedback directly from employers, offering insights into students' performance before graduation. The co-op employer survey uses a 5-point scale (1 to 5), which is then converted to a 0-4 level-of-attainment scale. To align with SLO 1, the survey asks the following question:

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

Criteria for Success (Thresholds for Assessment Methods):

Each individual assessment tool contributes to the overall level of attainment for the SLO (Alumni survey 10%, Senior Exit Survey 10%, Course Term Project External Evaluation 15%, Course-embedded Assessment 25%, Senior Design Project 20%, and Co-op Employer Survey 20%). The expected level of attainment of the SLO 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.

Link to 'Tech Tomorrow' Strategic Plan:

1.A Experiential Learning, 2.A Technology Infused Programs

Results and Analysis:

SLO 4: ANALYSIS - Conduct standard tests, measurements, and experiments

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

Fall 2023

| 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 2023 | Alumni Survey | 3.09 | 25 | 3.40 (84.95%) |
| | Senior Exit Interview | 3.66 | 25 | |
| | COOP | - | | |
| | Term Project | - | | |
| | Course-embedded Assessment | - | | |
| | Senior Design Project: MET4620 | 3.42 | 50 | |

Justification for assigned levels-of-attainment of ABET student outcome 4 in Fall 2023:

- The attainment of SO4 in Fall 2023 is “3.40”, indicating that students can apply components of SO4.
- MET invested \$20,000 for Electricity Lab enhancement.
- Tutco donated \$3,500 for wiring station for senior projects.
- Herrick foundation donated \$150,000 for a new power supply in foundry.
- Capstone project evaluations are revised to shorten the feedback and received factual outcomes from advisory board and faculty.

- Faculty and adjuncts were trained on SO4.

Use of Results to Improve Outcomes:

Spring 2024

| 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 |
|-------------------|--|---------------------|------------|-----------------------------|
| Spring 2024 | Alumni Survey | 3.09 | 13 | 3.18 (79.49%) |
| | Senior Exit Interview | 3.33 | 13 | |
| | COOP | 2.4 | 23 | |
| | Term Project | - | | |
| | Course-embedded Assessment | 3.47 | 28 | |
| | Senior Design Project: MET4620 | 3.57 | 23 | |

Justification for assigned levels-of-attainment of ABET student outcome 4 in Spring 2024:

- The attainment of SO4 in Spring 2024 is “3.18”, indicating that students can apply components of SO4.
- Same as above.

Attached Files: See Appendix 5

Use of Results to Improve Outcomes:

- Low number of Coop students is a concern. More ways should be searched to increase the number or lower down the contribution of Coop’s weighting.
- Assessment tool of Term Projects’ judging is not used for SLO4.
- Finding ways to add more courses for the course embedded assessment.
- In order to improve the SO4, several evaluations are investigated in Applied Physical Metallurgy (MET3100).
- In order to improve the SO4, several evaluations will be investigated in MET3200 (Applied Electricity and Electronics).
- In order to improve the SO4, the plan will be to task some of the teams to engage more SO4 during the project progression.

Attached Files: See Appendix 5

SLO 5: TEAMWORK: Function as a technical team member and leader

Define Outcome:

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

Assessment Methods:

Alumni Survey - Indirect Assessment Tool: The survey is conducted every three years to evaluate the professional growth of our graduates. The University Advancement conducts this survey, which is sent to program graduates from the past five years. 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. To align with SLO 1, the survey asks the following question:

Based on your experiences while in our 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.

Senior Exit Survey - Indirect Assessment Tool: An online survey is one part of the Graduating Senior Exit Interview process. It is handed by the College of Engineering. 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 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.

Course Term Project External Evaluation - Direct Assessment Tool: The departmental graduate students and/or adjuncts are used as external evaluators to assess some of the technical courses' term project presentations. An evaluation form was developed for this purpose. The external evaluation of term projects' assessment tool uses a "0-10" scale which is then converted to the 0-4 level-of-attainment scale. To align with SLO 1, The survey asks the following question:

The student presents an ability to function effectively as a member as well as a leader on technical teams throughout the term project presented today. YOUR ANSWER: 1-10 (1 is lowest, 10 is highest). Explain very briefly why you gave this grade

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.

Senior Design Project – Direct Assessment Tool: Capstone projects, along with their mockups, posters, and presentations, are showcased to the METAB advisory board members and program faculty. The assessment tool employs a 1-5 level of attainment scale, which is then averaged and converted to a 0-4 scale. To align with SLO 1, the survey asks the following question to the METAB advisory board members and program faculty:

Did the team leader and members function well together?

Co-op Employer Survey - Direct Assessment Tool: Few program students participate in the co-op program during their time at Tennessee Tech. For co-op jobs sponsored by Tennessee Tech, employers are required to complete a formal evaluation of each student's performance at the end of each co-op semester. Additionally, employers of College of Engineering students are asked to respond to further assessment questions, some of which pertain to Student Outcomes. Co-op surveys provide valuable feedback directly from employers, offering insights into students' performance before graduation. The co-op employer survey uses a 5-point scale (1 to 5), which is then converted to a 0-4 level-of-attainment scale. To align with SLO 1, the survey asks the following question:

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

Criteria for Success (Thresholds for Assessment Methods):

Each individual assessment tool contributes to the overall level of attainment for the SLO (Alumni survey 10%, Senior Exit Survey 10%, Course Term Project External Evaluation 15%, Course-embedded Assessment 25%, Senior Design Project 20%, and Co-op Employer Survey 20%). The expected level of attainment of the SLO 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.

Link to 'Tech Tomorrow' Strategic Plan:

1.A Experiential Learning, 2.A Technology Infused Programs

Results and Analysis:

SLO 5: TEAMWORK - Function as a technical team member and leader

Overall level of attainment of student outcome 5, based on the evaluation of the assessment data.

Fall 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 |
|-------------------|--|---------------------|------------|-----------------------------|
| Fall 2023 | Alumni Survey | 3.50 | 10 | 3.79 (94.67%) |
| | Senior Exit Interview | 3.66 | 10 | |
| | COOP | 4 | 20 | |
| | Term Project | 4 | 15 | |
| | Course-embedded Assessment | 3.74 | 25 | |
| | Senior Design Project: MET4620 | 3.68 | 20 | |

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

- The attainment of SO5 in Fall 2023 is “3.79”, indicating that students can apply components of SO5.
- ATC donated \$300,000 laser welding machine to MET.
- Tutco donated \$3,500 for wiring station for senior project.
- Herrick foundation donated \$150,000 for a new power supply in foundry.
- Industrial projects and METAB support are essential.
- Several courses offer team projects as an end of semester term project.
- Extracurricular activities of department in SME, AFS and FSAE support the SLO5.

Spring 2024

| 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 2024 | Alumni Survey | 3.50 | 10 | 3.60 (89.89%) |
| | Senior Exit Interview | 3.57 | 10 | |
| | COOP | 3.2 | 20 | |
| | Term Project | 3.8 | 15 | |
| | Course-embedded Assessment | 3.72 | 25 | |
| | Senior Design Project: MET4620 | 3.75 | 20 | |

Justification for assigned levels-of-attainment of ABET student outcome 5 in Spring 2024:

- The attainment of SO5 in Spring 2024 is “3.60”, indicating that students can apply components of SO5.
- Same as given above.

Attached Files: See Appendix 6

Use of Results to Improve Outcomes:

- Graduate students and research projects will be used for the further senior design projects. So, Seniors and graduate students will work jointly.
- MET2065 reorganization to allow an instructor to be closer to the students during the labs.
- Dr. Baswell continuously revises and restructures his operations for capstone teams.
- Suggest students to participate in more extracurricular activities.
- More diverse projects will be assigned with industrial support.

Attached Files: See Appendix 6

Summative Evaluation:

MET Department has been continuously monitoring the attainment of all Student Learning Outcomes (SLOs) closely. For this important task, the department established an assessment committee two years ago. All SLOs are continuously monitored by the committee and corrective actions are taken if any low attainment levels are observed.

Last year, Faculty Course Assessment Report (FCAR) was removed, and it is not used for measuring the SLO attainment levels anymore. The weighting of the assessment tools which provides direct measures have the highest weightings. Two indirect assessment tools (student exit interviews and alumni surveys) have the lowest weighting considering their indirect contributions to final scores. As it could be seen from the indirect survey findings, the scores provided by the students and alumni are extremely high at the attainment levels and this is a very good indicator of the high-quality education and impact of the current ET program. Senior Exit Surveys are handled by the College of Engineering and Alumni surveys are handled by the University Advancement. The data provided by these two units are analyzed by the MET department.

The lowest attainment is on the SLO4 at this time. The department will train its faculty and lecturers on SLO4 and its importance. More labs will be developed in Electricity, Casting, and Material Characterization so that more courses and curricular practices are used to measure the attainment of SLO4.

Assessment Plan Changes:

There will not be any change for the near future about the assessment plan. However, the assessment tools and collected data will be continuously monitored by the departmental assessment committee. In any deficiency and/or low ratings, the committee will take quick actions to make changes and revisions on the current assessment plan.

List of Appendices:

Appendix 1: Engineering Technology BSET Curriculum Map

Appendix 2: SLO1 Results

Appendix 3: SLO2 Results

Appendix 4: SLO3 Results

Appendix 5: SLO4 Results

Appendix 6: SLO5 Results

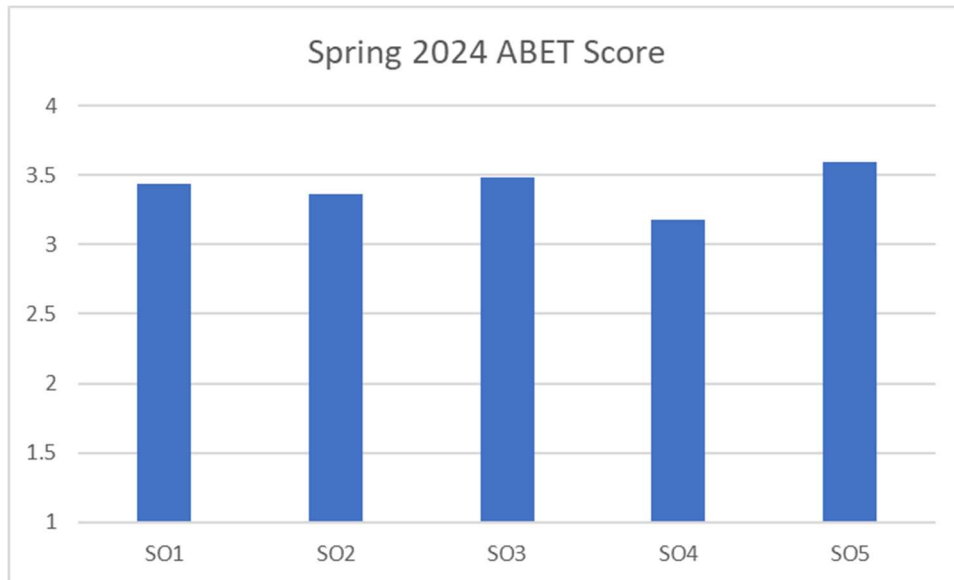
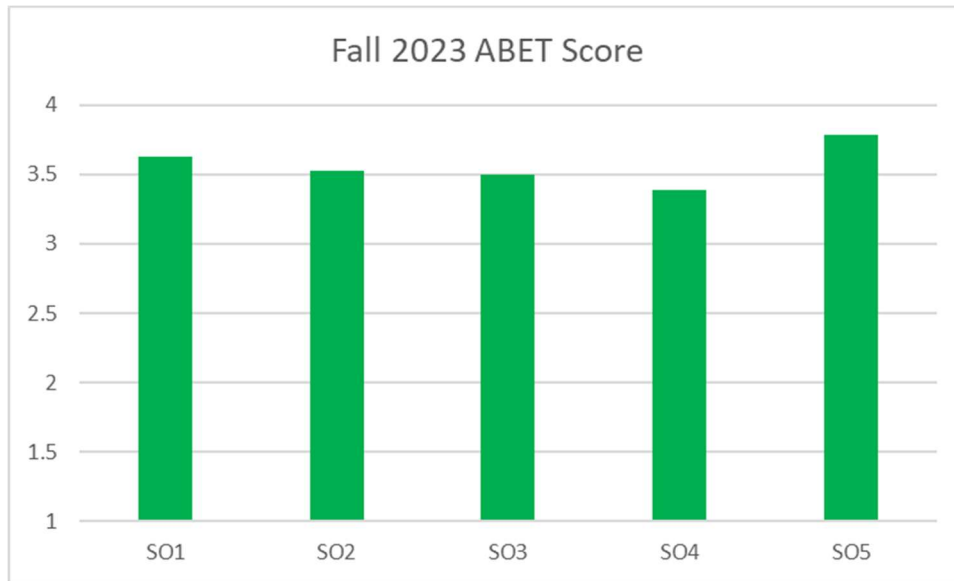
Appendix 1: Engineering Technology BSET Curriculum Map

| Course | Title | Pre-reqs | Co-reqs | FALL | SPR | SUM | SO1 | SO2 | SO3 | SO4 | SO5 |
|----------|--|--|------------------------|------|-----|-----|-----|-----|-----|-----|-----|
| MET 1115 | Intro to MET & Engr Ethics | | | X | X | | z | zφ | zφ | | zφ |
| MET 2000 | Occupational Safety | | | | X | | | | | | |
| MET 2065 | Metal Manufacturing Technology | ENGR 1110, MET 1115, MATH 1710 & 1720 or MATH 1730 or MATH 1910 or MATH 1920 | | X | X | | z | z | | | |
| MET 2400 | Statics/Strengths of Materials | MATH 1710 & 1720 or MATH 1730 or MATH 1910, PHYS 2010 or PHYS 2110 | | X | X | | zφ | | zφ | zφ | |
| MET 3003 | Principals of Metal Casting | ENGR 1110, MET 1115, MET 3100 or ME 3010 | MET 3100 or ME 3010 | X | X | | | z | | z | |
| MET 3060 | Comp Num Cont Mchng Prct | ENGR 1120, MET 2065 | | X | X | | zβφ | zβ | zβφ | | zβφ |
| MET 3100 | Applied Physical Metallurgy | MET 1115, CHEM 1010 or CHEM 1110 | | X | X | | | | | | |
| MET 3150 | Maintenance Technology | Junior Standing | | X | X | | zφ | | zφ | | φ |
| MET 3200 | App Electricity & Electronics | MATH 1845 or MATH 1910, PHYS 2020 or PHYS 2120 | PHYS 2020 or PHYS 2120 | X | X | X | z | z | | z | |
| MET 3270 | Industrial Electronics & PLCs | MET 3200 | | X | X | | z | z | | z | z |
| MET 3303 | CAD for Technology | ENGR 1110 | | X | X | | zφ | | zφ | zφ | zφ |
| MET 3403 | Applied Machine Elements | MET 2400, MET 3303 | | X | X | X | zφ | z | zφ | zφ | φ |
| MET 3703 | Manufacturing Cost Estimating | MET 2065 | | X | | | zφ | zφ | zφ | | |
| MET 3713 | Methods Dsgn/Work Measurement | MET 2000, MET 2065 | | X | | | | | | | |
| MET 4000 | Advanced Foundry Technology | MET 3003 | | X | | | z | z | | | |
| MET 4220 | Industrial Automation/Robotics | MET 3270 | | X | X | | zφ | zφ | z | | |
| MET 4250 | Applied Mechatronics | MET 3270 | | X | X | | z | zφ | z | | φ |
| MET 4310 | Plant Layout/Mtrl Handling | MET 3303 | | X | X | X | zβφ | zβφ | zβφ | | zβ |
| MET 4550 | Mntnce, Rplcmnt, Riblty Engr | Senior standing in engineering, engineering technology, or business | | | X | | zβφ | zφ | zφ | zφ | zφ |
| MET 4600 | Product Design & Development | Senior standing in engineering, engineering technology, or business | | | X | | | zφ | zφ | | zφ |
| MET 4620 | Senior Projects | MET 3403 | | X | X | | zλ | zλ | zλ | zλ | zλ |
| MET 4650 | Lean Six Sigma Mfg | Senior standing in engineering, engineering technology, or business | | X | X | | | | | | |
| MET 4990 | Special Problems | Senior standing in engineering, engineering technology, or business | | X | | | | | | | |
| MET 4120 | Process and Control Apps | MET 3270 | | | | | | | | | |
| MET 3620 | Intro to Industrial IoT Syst. | ENGR 1120, MET 3200 | | | X | | | | | | |
| MET 4320 | Mixed Reality in Manufacturing | MET 3620 | | | | | | | | | |
| MET 4420 | Introduction to Additive Manufacturing | MET 3620 | | | | | | | | | |
| MET 4520 | Autonomous Robots in Manufacturing | MET 4320 | | | | | | | | | |
| MET 4720 | Senior Projects/Smart Manufacturing | MET 3403, MET 3260 | | | X | | | | | | |

| Legend: |
|--|
| Courses address the ABET Student Outcomes, z |
| Term Project External Evaluation, β |
| Course-embedded Assessment, φ |
| METAB Evaluation, λ |

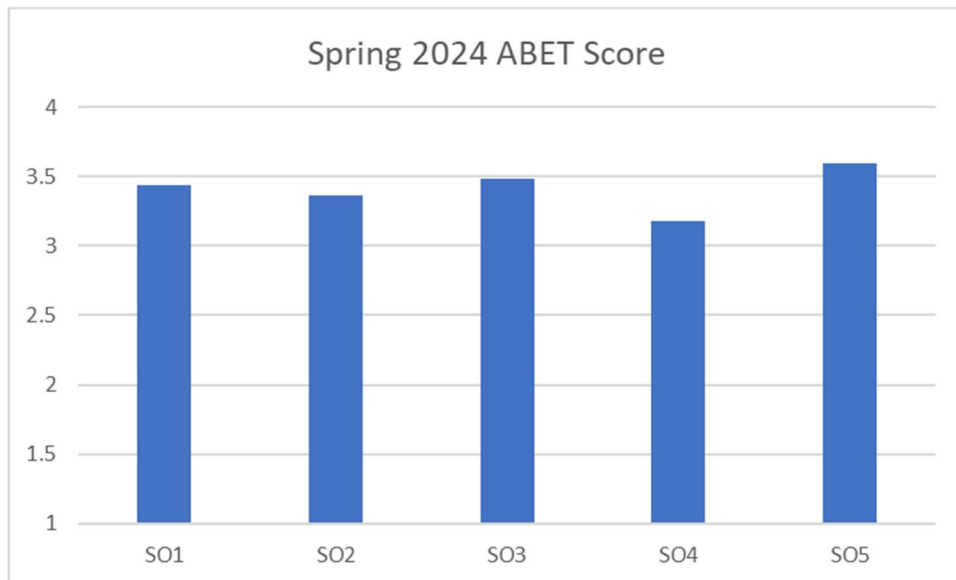
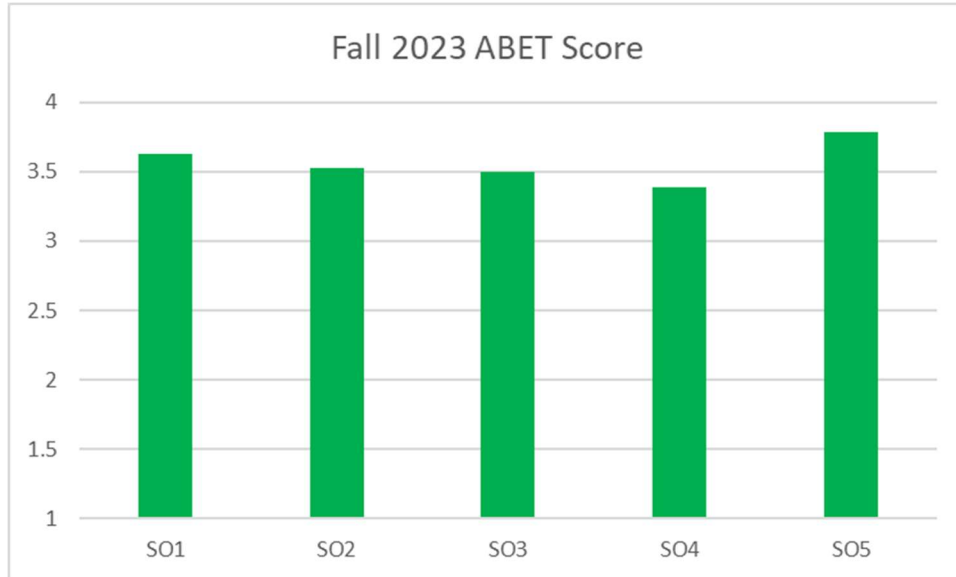
Appendix 2: SLO1 Results

Graphical Representation of The Attainment of All Student Outcomes

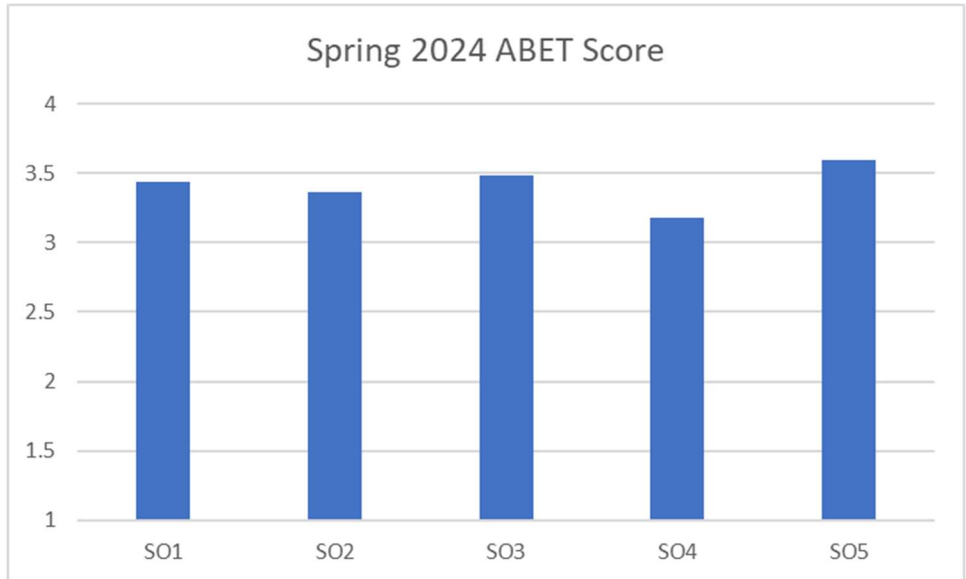
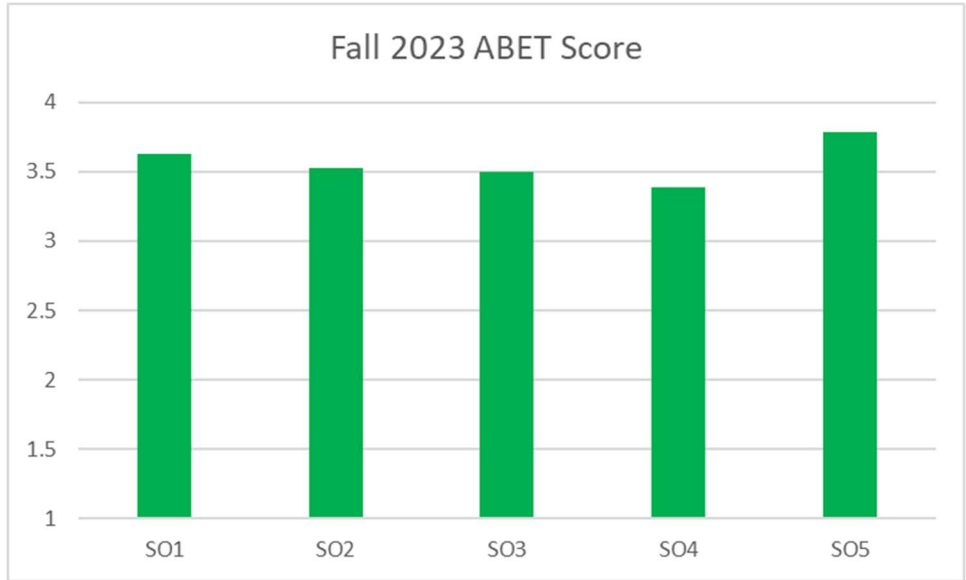


Appendix 3: SLO2 Results

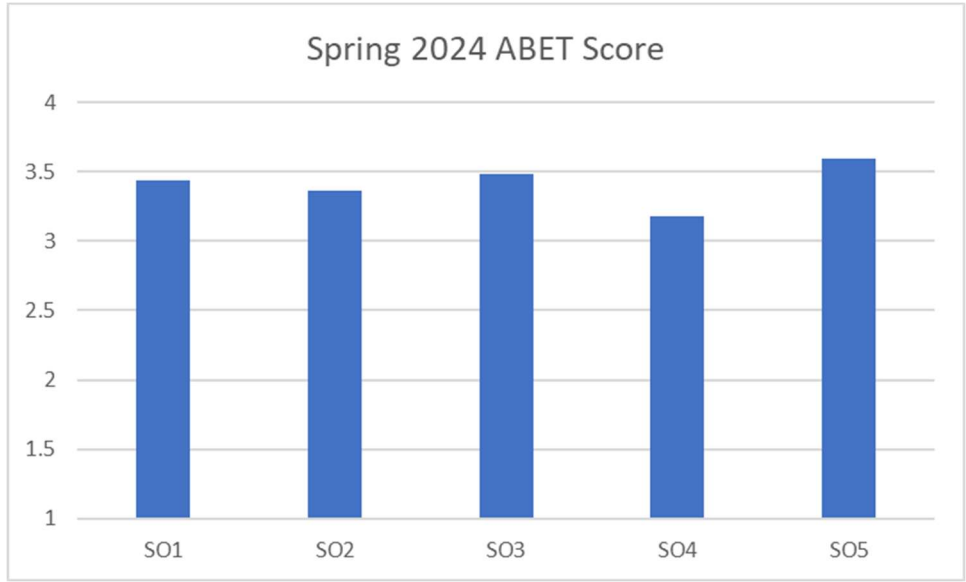
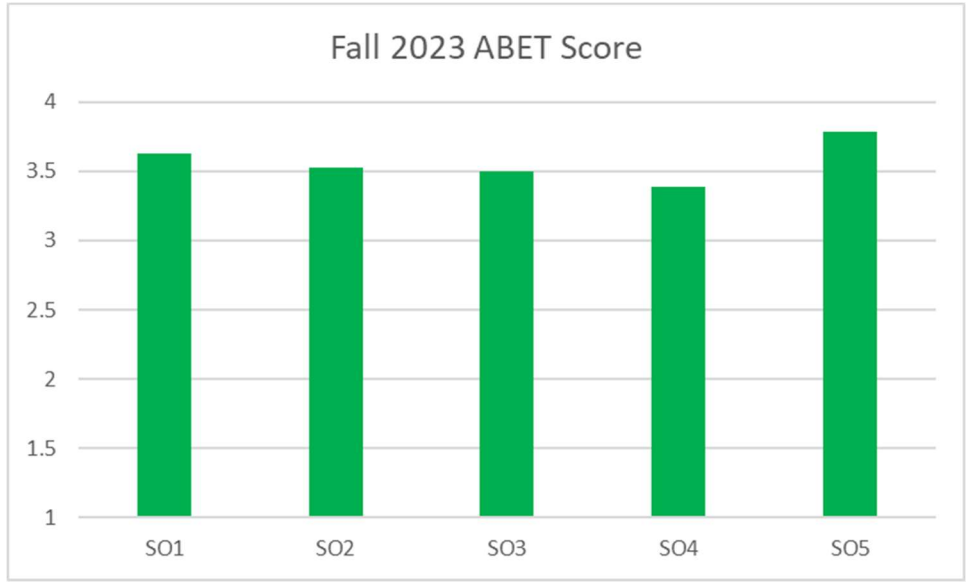
Graphical Representation of The Attainment of All Student Outcomes



Appendix 4: SLO3 Results
Graphical Representation of The Attainment of All Student Outcomes



Appendix 5: SLO4 Results
Graphical Representation of The Attainment of All Student Outcomes



Appendix 6: SLO5 Results

Graphical Representation of The Attainment of All Student Outcomes

