

## Assessment Cycle 2022-2023

### Program: Bachelor of Science (BS), Industrial Engineering Technology (145)

College: Arts and Sciences

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**Northwestern Mission.** Northwestern State University is a responsive, student-oriented institution committed to acquiring, creating, and disseminating knowledge through innovative teaching, research, and service. With its certificate, undergraduate, and graduate programs, Northwestern State University prepares its increasingly diverse student population to contribute to an inclusive global community with a steadfast dedication to improving our region, state, and nation.

**College of Arts and Sciences Mission.** The College of Arts & Sciences, the largest college at Northwestern State University, is a diverse community of scholars, teachers, and students, working collaboratively to acquire, create, and disseminate knowledge through transformational, high-impact experiential learning practices, research, and service. The College strives to produce graduates who are productive members of society equipped with the capability to promote economic and social development and improve the overall quality of life in the region. The College provides an unequaled undergraduate education in the social and behavioral sciences, English, communication, journalism, media arts, biological and physical sciences, and the creative and performing arts, and at the graduate level in the creative and performing arts, English, TESOL, and Homeland Security. Uniquely, the College houses the Louisiana Scholars' College (the State's designated Honors College), the Louisiana Folklife Center, and the Creole Heritage Center, demonstrating its commitment to community service, research, and preservation of Louisiana's precious resources.

**Engineering Technology Department Mission:** The Engineering Technology Department is dedicated to delivering high-quality education in the areas of engineering technology, electronics engineering technology, and industrial engineering technology, as well as pre-engineering preparation. The department prepares students for successful careers and enriched lives in the public, private, and non-profit sectors, and promotes economic development and enrichment of the communities we serve.

**Industrial Engineering Technology Mission Statement:** The mission of the Industrial Engineering Technology program is to produce four-year graduates with the breadth and depth of knowledge in industrial engineering technology to become lifelong productive members of the regional workforce and the local society.

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**Purpose:** The Bachelor of Science in Industrial Engineering Technology program will prepare students to: 1) analyze, test, build, operate, and maintain industrial systems (equipment, warehouse operations, safety management, plant operations, *etc.*), and 2) manage manufacturing facilities, systems, and operations to include installation, motion and time, safety, and efficiency. It prepares students for entry positions in government and the private sector in which the ability to implement changes, upgrade operations, set-up equipment, analyze problems, and modify if necessary is increasingly critical. It will also prepare interested students for the pursuit of advanced degrees in Engineering and Technology at other institutions.

**Methodology:** The assessment process for the BS in Industrial Engineering Technology program is as follows:

- (1) Data from assessment tools (both direct – indirect, quantitative, and qualitative) are collected and returned to the department head and ET ABET committee
- (2) The department head and ET ABET committee analyze the data to determine whether students have met measurable outcomes
- (3) Results from the assessment are discussed with the program faculty
- (4) The department head, in consultation with the Engineering Technology Advisory Board, will propose changes to measurable outcomes, assessment tools for the next assessment period, and, where needed, curricula and program changes.

### Student Learning Outcomes (SLOs):

Student learning outcome data was collected, analyzed, and reported for the Industrial Engineering Technology degree program. Measures used to collect data include reports, case studies, projects, exams, presentations, and written exercises. Assessment data for the academic cycle (AC) 2022-2023 show that targets were met or exceeded. Most of the students' performance indices for all SLOs were found to be satisfactory. For those assessments where the targets were not met, action plans were devised and implemented in the next cycle.

From these results, there were several key actions recommended and decisions made to enhance the student experience and student learning outcomes with the focus on assuring that students meet and exceed target expectations.

**SLO 1. Ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined industrial engineering problems (ETAC of ABET Outcome 1).**

**Course Map:** Tied to the course syllabus objectives.

**IET 4700:** Manufacturing Facilities

**IET 4960:** Project Design II

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**Measure 1.1.** Every spring semester, students are graded using a rubric measuring their ability to design and solve rotary table for manufacturing facilities in IET 4700. The acceptable target is 80% of students score at least 12 out of 16 on the rubric-based assessment of the assignment.

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of the AC 2021-2022 results, the faculty implemented the following changes in AC 2022-2023 to drive the cycle of improvement. The problems were amended to include multiple manufacturing supply and processing lines in the existing scenario that was given to students in the past.

In AC 2022-2023, the target was met with 10 out of 11 (91%) of the students scoring at least 12 out of 16 (75%) on a rubric-based assessment of the assignment on “design and solve rotary table for manufacturing facilities”. Even though multiple manufacturing supply and processing lines were added to the problem this year, the performance level was maintained. The instructor continued to make teams with leveled strengths across the groups.

**Decision:** Based on the results of AC 2022-2023, the faculty will implement the following changes in AC 2023-2024 to drive the cycle of improvement. To promote the random selection of team members driven by the students, the instructor will pick the best-performing students to serve as the captains of the teams, and they will be allowed to choose their members one at a time until all the students are selected. The motivation behind this is to promote team cohesiveness and eliminate instructor bias in team formation.

**Measure 1.2.** Every spring semester, upon submission of IET 4960 project reports, ET faculty evaluate student performance with respect to their ability to apply industrial engineering technology knowledge, skills, and tools to real-world problem-solving. The acceptable target is 80% of IET students rate at least 80 out of 100 (80%) on the checklist-based assessment of the technical portion of the project report.

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of AC 2021-2022 results, in AC 2022-2023, the faculty made the following changes. To avoid a low degree of technical content in the final report, the teams were required to present a draft focusing only on outlines of the process used to transition the theory/methodology to solution calculation and recommendations. This report was due and graded as a part of the midterm grade for each team member and was incorporated into their final grade.

Because of these changes, in AC 2022-2023, the target was met with 5 out of 5 (100%) students rated at least 80 out of 100 (80%) on the checklist-based assessment of the technical portion of the project report.

**Decision:** Based on the results of the AC 2022-2023 and to drive the cycle of improvement, the faculty will implement the following changes in AC 2023-2024. The instructor of the course will hold review sessions on the technical topics relevant to the individual project

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for each team and provide related lecture notes. The technical topics may come from Engineering Economics, Methods and Work Design, Industrial Simulation, Statistics, Operations Research, etc. It is noted by the instructor that these refresher courses may enhance the quality of the technical portion of the final project report.

**SLO 2. Ability to perform tests, measurements, and experiments to analyze and improve processes. (ETAC of ABET Outcome 4).**

**Course Map:** Tied to the course syllabus objectives.

**IET 3510:** Motion and Time Study

**IET 4720:** Quality Control

**Measure 2.1.** Every fall semester, students' grades on the semester projects in IET 3510 are used to assess the achievement of SLO 2. The acceptable target is 80% of students score at least 12 out of 16 (75%) on the rubric-based assessment of the project.

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of AC 2021-2022 results, the faculty implemented the following changes in AC 2022-2023 to drive the cycle of improvement. The instructor of IET 3510 arranged multiple practice sessions in the classroom for data collection and analysis for all students and offered an additional practice session for some students due to absence or as additional training for others.

As a result of these changes in AC 2022-2023, the target was met. Nine out of ten (90%) of the students scored at least 12 out of 16 (75%) on a rubric-based assessment of a group assignment. This was the first time since the pandemic that we were able to offer real industry projects at the site of the sponsor. Students experienced and learned how to work in a group. They also gained knowledge on the effect of upstream workstations on downstream workstations in a line processing environment. Though the students worked in small teams (10 students divided into 4 groups), they were asked to submit an individual project report. This experience helped them learn how to write a technical report as well. The instructor noted that five out of ten students had minor errors in calculations.

**Decision:** Based on the analysis of the AC 2022-2023 results, the faculty will implement the following changes in AC 2023-2024 to drive the cycle of improvement. The instructor of IET 3510 will (1) explain how a professional technical report needs to be prepared, 2) provide a template on the learning management system for students to download and use, and (3) offer an additional review of the draft or practice session for calculations required for the project if needed by any student(s).

**Measure 2.2.** Every spring semester, students are graded on an assignment of creating, analyzing, and interpreting control charts for variables or attributes in IET 4720 to assess the achievement of SLO 2. The acceptable target is 80% of students scoring at least 75% (12 out of 16) on the rubric-based assessment of the assignment.

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**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of AC 2021-2022, the instructor implemented the following changes in AC 2022-2023 to drive the cycle of continuous improvement. The instructor introduced Minitab software for Statistical Process Control (SPC) assignments in addition to the templates in MS Excel. Students were shown how Minitab calculates standard deviation based on the chart type and sample size. There was a requirement for students to manually calculate standard deviations for the purpose of SPC procedures.

As a result of these changes in AC 2022-2023, the target was met. Seven out of eight students (87.5%) scored at least 12 out of 16 (75%) on a rubric-based assessment of the assignment on control charts for variables. One student who usually performed well could not perform above the required threshold because the student was in an overwhelming family situation.

**Decision:** Based on the analysis of the AC 2022-2023 results and to drive the cycle of continuous improvement for AC 2023-2024, the instructor will implement the following changes. The instructor will introduce an individual practice problem on control charts for variables using Minitab software for Statistical Process Control (SPC). The assignment for the assessment will be updated to include the questions on detecting outliers and patterns of the plotted points.

**SLO 3. Ability to design systems, components, or processes meeting specified needs related to industrial engineering technology discipline (ETACof ABET Outcome 2).**

**Course Map:** Tied to course syllabus objectives.

**IET 3510:** Motion and Time Study

**IET 4700:** Manufacturing Facilities

**Measure 3.1.** Every fall semester, students' grades on the "assignment on ergonomics principles in a workplace" in IET 3510 are used to assess the achievement of SLO 3. The acceptable target is 80% of students scoring at least 12 out of 16 (75%) on the rubric-based assessment of the assignment.

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of the AC 2021-2022 results, the faculty implemented the following changes in AC 2022-2023 to drive the cycle of improvement. These changes included contacting local industries for real-ergonomics-related projects for the students and providing ergonomics-related videos of industrial operations to the students to bolster their understanding of ergonomics in action in industrial settings.

As a result of these changes in AC 2022-2023, the target was met. Nine out of ten students (90%) students scored at least 12 out of 16 (75%) on the rubric-based assessment. This was the first time since the pandemic that the students in this course had

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an opportunity to work on a real project. Students reported learning by citing various ergonomics principles and their uses in the project. The instructor noticed that the report did not have sufficient relevant theory or design attributes and calculations.

**Decision:** Based on the analysis of the AC 2022-2023 results, in AC 2023-2024, the instructor will implement the following changes: (1) students will be asked to provide sufficient theoretical background in their report with a relevant brief review of the chapters related to the ergonomics principles, (2) students will be asked to show the relevant guideline to make their case for the recommended design attributes, and 3) the instructor will offer any group a review of the report before the due date.

**Measure 3.2.** Every spring semester, students are graded on a timed assignment of a warehouse lighting project in IET 4700 to assess the achievement of SLO 3. The acceptable target is 80% of students scoring at least 12 out of 16 (75%) on the rubric-based assessment of the assignment.

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of AC 2021-2022 results, the faculty implemented the following changes in AC 2022-2023 to drive the cycle of continuous improvement. Based on the grades from the individual practice assignment, the final team selection was made in such a way that the team strength was evenly balanced.

In AC 2022-2023, the target was met with 10 out of 11 (91%) of the students scoring at least 12 out of 16 (75%) on the rubric-based assessment of the warehouse lighting project. One student did not come to class on the day of this assessment and did not make up the assignment even when repeated opportunities were given.

**Decision:** Based on the analysis of the AC 2022-2023 results, the faculty will implement the following changes in AC 2023-2024 to drive the cycle of continuous improvement. The updated version of the assessment will include certain parameters with unassigned values; thus, the team will have to produce reasonable assumptions to solve the problem.

**SLO 4. Ability to function effectively as a member of a team or as its leader (ETAC of ABET Outcome 5).**

**Measure 4.1.** Every fall semester, students in EET 4940 assess their peers on a technical team concerning their ability and skill as a member or a leader of the team based on a checklist-based peer-review survey. The acceptable target is 80% of IET students are rated at least 20 out of 25 (80%) on a checklist-based peer-review survey.

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of the AC 2021-2022 results, the faculty implemented the following changes in AC 2022-2023 to drive the cycle of improvement. Each member of the team rated themselves on various aspects of the project design course components related to team assignments. The instructor of the course developed a table of such factors or dimensions relevant to being

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an effective member/leader of the team from the perspective of team assignments. The rating was done by each member on these dimensions using a 1 to 10 scale where 10 means strong and 1 means do not feel comfortable in that dimension. This led to a better team member task assignment and a better outcome for individual effort leading to better harmony and cohesiveness within the team.

As a result of these changes in AC 2022-2023, the target was met. In AC 2022- 2023, 10 out of 10 (100%) of the students were rated at least 20 out of 25 (80%) on the checklist-based peer-review survey. Only one student received negative comments that he was the only one to miss group meetings on several occasions and had less participation in teamwork assignments. Most of the students scored 100% except for this one student who scored in the eighties.

**Decision:** Based on the analysis of the AC 2022-2023 results and to drive the cycle of improvement, the following changes will be applied in AC 2023-2024. As soon as there is an indication of non-participation or less participation in team-related activities, the team leader will be asked to hold a one-on-one meeting with the team member concerned and try to understand the situation. The team leader will be asked to make clear that participation is expected from each member to deliver their part of the group assignment on time. After this meeting, if the problem persists, the instructor of the course to be notified at once. The instructor then will have a meeting with this individual and will explain the consequences of below-par participation. The instructor will remind the student that there is 20% of the semester grade is based on professionalism and it may adversely affect the grade of the students in the course. This will be taken only as the last resort after exhausting all efforts to motivate the student to be an effective team member.

**Measure 4.2.** Every spring semester, the instructor of the course rates students in IET 4960 based on their ability and skill as a member or a leader of the team on a checklist-based review survey. An instructor will use the overall impression of the team based on a semester-long interaction with the team to rate the team members and leaders. The acceptable target is 80% of students are rated at least 20 out of 25 (80%) on a checklist-based survey.

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was not met with only 7 out of 11 (63.6%) of the students meeting the criteria. Based on the analysis of the AC 2021-2022 results and to address the issue of lapse of a strong commitment to timeliness, teamwork, and communication with the instructor, the instructor of the course introduced a graded item assessed for the midterm test which included a semi-finished project report with a detailed “list of not yet finished items” and the action plans for the remainder of the semester to successfully meet the project goals and objectives.

Because of this change in AC 2022- 2023, the target was met with 4 out of 5 (80%) of the students meeting the criteria. One member of one group of three students had already started a full-time position in a local company and was often non-responsive to repeated attempts by the team members/instructor to establish communication. The other two members of the team became increasingly dedicated to successfully

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completing the project to their client's satisfaction.

**Decision:** Based on the analysis of the AC 2022-2023 results and to drive the cycle of improvement, the faculty will implement the following change in AC 2023-2024. Each member and the leader of the team will have to submit a detailed progress report including action plans and their corresponding due dates at the end of each month. At the beginning of the semester, each group must submit the schedule for the semester that includes due dates for the draft report chapter-wise, presentation slides, and poster such that there is enough time for faculty feedback, correction, and updates.

### **SLO 5. Ability to communicate effectively (ETAC of ABET Outcome 3).**

**Measure 5.1.** Every fall semester, upon presentation of capstone projects in IET 4940, ET faculty evaluate student performance concerning the ability to communicate effectively in the oral presentation of the technical report. The acceptable target is 80% of IET students to score at least 80 out of 100 (80%) on a checklist-based assessment of the oral presentation.

**Course Map:** Tied to course syllabus objectives.

**IET 4940:** Project Design I

**IET 4960:** Project Design II

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of AC 2021-2022 results, the faculty implemented the following changes in AC 2022-2023 to drive the cycle of improvement. Each team had to make their presentation template ready by the midterm. All the sections of the presentation that the team could complete were prepared and submitted to the instructor for feedback. The instructor of the course made the guidelines for the presentation available to the students in the first week of the project. This helped all groups to perform better in both the oral presentations and the written final reports.

As a result of the changes, the target was met in AC 2022-2023. In AC 2022-2023, 5 out of 5 (100%) of the students were rated at least 80 out of 100 (80%) on the checklist-based assessment of an oral presentation by the ET faculty. There were minor comments regarding the attire of some of the students. In addition, no teams implemented all the comments and feedback provided by the faculty during the practice run. It was also felt that the teams could have used appropriate audio-visual aids during the presentation.

**Decision:** Based on the analysis of the AC 2022-2023 results and to drive the cycle of improvement, faculty will implement the following changes in AC 2023-2024: 1) team will be notified that business casual attire is accepted attire while business formal attire is recommended for presentation, 2) more penalties will be assessed for the team not addressing all the comments/suggestions provided by the faculty during the practice run, and 3) teams will be asked to think of audio-video aids and get feedback from the



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instructor in a timely manner to enhance the efficacy of the presentation.

**Measure 5.2:** Every spring semester, upon submission of capstone project reports in IET 4960, ET faculty evaluate students with respect to their ability to write a technical report using relevant literature, graphs, charts, results, and recommendations adhering to the format prescribed by the instructor to assess the achievement of SLO 5. The acceptable target is 80% of IET students rated at least 80 out of 100 (80%) on checklist-based assessment of the written project report.

**Finding:** Target was met.

**Analysis:** In AC 2021-2022, the target was met. Based on the analysis of the AC 2021-2022 results, in AC 2022-2023, the target was met. The instructor of the course met with each group and explained how to address a rubric item such as “Text is unbiased and free from group stereotype” and explained “properly citing sources” used for the project. As a result of these changes in AC 2022-2023, 5 out of 5 (100%) students scored at least 80 out of 100 (80%) on the checklist-based assessment of the written project report.

**Decision:** Based on the analysis of the AC 2022-2023 results and to drive the cycle of improvement, the following changes will be implemented in AC 2023-2024. The instructor of the course will hold a tutorial session on MS Word and Excel focusing on formatting, including mathematical notations/equations, and auto-referencing.

### Comprehensive Summary of the Key Evidence of Improvement Based on Analysis of Results:

The following reflects all the changes implemented to drive the continuous process of seeking improvement in AC 2022-2023. These changes are based on the knowledge gained through the analysis of AC 2021-2022 results.

- In IET 3510 (SLO 2), the instructor arranged multiple practice sessions in the classroom for data collection and analysis for all students and offered an additional practice session for some students due to absence or as additional training for others.
- In IET 3510 (SLO 3), the instructor contacted local industries for ergonomics-related projects for the students and provided ergonomics-related videos of industrial operations to the students to bolster their understanding of ergonomics in action in industrial settings.
- In EET 4940 (SLO 4), each member of the team rated themselves on various aspects of the project design course components related to team assignments. The instructor of the course developed a table of such factors or dimensions relevant to being an effective member/leader of the team from the perspective of team assignments. The rating was done by each member on these dimensions on a 1 to 10 scale where 10 meant strong and 1 meant do not feel comfortable in that dimension. This led to a better team member task assignment and a better outcome for individual effort leading to better harmony and cohesiveness within

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the team.

- In IET 4700 (SLO 1), the problems were amended to include multiple manufacturing supply and processing lines in the existing scenario that was given to students in the past.
- In IET 4700 (SLO 3), based on the grades from the individual practice assignment, the final team selection was made in such a way that the team strength was evenly balanced.
- In IET 4720 (SLO 2), the instructor introduced Minitab software for Statistical Process Control (SPC) assignments in addition to the templates in MS Excel. Students were shown how Minitab calculates standard deviation based on the chart type and sample size. There was a requirement for students to manually calculate standard deviations for the purpose of SPC procedures.
- In IET 4960 (SLO 1), to avoid a low degree of technical content in the final report, the teams were required to present a draft focusing only on outlines of the process used to transition the theory/methodology to solution calculation and recommendations. This report was due and graded as a part of the midterm grade for each team member and was incorporated into their final grade.
- In IET 4960 (SLO 4), to address the issue of lapse of a strong commitment to timeliness, teamwork, and communication with the instructor, the instructor of the course introduced a graded item assessed for the midterm test which included a semi-finished project report with a detailed “list of not yet finished items” and the action plans for the remainder of the semester to successfully meet the project goals and objectives.
- In IET 4960 (SLO 5), the instructor met with each group and explained how to address a rubric item such as “Text is unbiased and free from group stereotype” and explained “properly citing sources” used for the project.

### Plan of action moving forward:

- The instructor of IET 3510 will (1) explain how a professional technical report needs to be prepared, (2) provide a template on the learning management system for students to download and use, and (3) offer an additional review of the draft or practice session for calculations required for the project if needed by any student(s).
- In IET 3510 (SLO 3), the instructor will implement the following changes: (1) students will be asked to provide a sufficient theoretical background in their report with a relevant brief review of the chapters related to the ergonomics principles, (2) students will be asked to show the relevant guideline to make their case for the recommended design attributes, and (3) the instructor will offer any group a review of the report before the due date.
- In IET 4940 (SLO 4), as soon as there is an indication of non-participation or less

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participation in team-related activities, the team leader will have one-on-one meetings with the team member concerned and try to understand the situation. The team leader will make clear that participation is expected from each member to deliver their part of the group assignment on time. After this meeting, if the problem persists, the instructor of the course will be notified at once. The instructor then will have a meeting with this individual and will explain the consequences of below-par participation. The instructor needs to remind the student that there is 20% of the semester grade is for professionalism and it may adversely affect the grade of the students in the course.

- In IET 4700 (SLO 1), to promote a random selection of team members driven by the students, the instructor will pick the best-performing students to serve as the captains of the teams and they will be allowed to choose their members one at a time until all the students are selected. This will promote team cohesiveness and eliminate instructor bias in team formation.
- In IET 4700 (SLO 3), the updated version of the assessment will include certain parameters with unassigned values; thus, the team will have to produce reasonable assumptions to solve the problem.
- In IET 4720 (SLO 2), the instructor will introduce an individual practice problem on control charts for variables using Minitab software for Statistical Process Control (SPC). The assignment for the assessment will be updated to include the questions on detecting outliers and patterns of the plotted points.
- In IET 4960 (SLO 1), the instructor will hold review sessions on the technical topics relevant to the individual project for each team and provide related lecture notes. The technical topics may come from Engineering Economics, Methods and Work Design, Industrial Simulation, Statistics, Operations Research, *etc.* This will hopefully enhance the quality of the technical portion of the final project report.
- In IET 4960 (SLO 4), each member and the leader of the team will have to submit a detailed progress report including action plans and their corresponding due dates at the end of each month. At the beginning of the semester, each group will submit the schedule for the semester that includes due dates for the draft report chapter-wise, presentation slides, and poster such that there is enough time for faculty feedback, correction, and updates.
- In IET 4960 (SLO 5), the instructor will hold a tutorial session on MS Word and Excel focusing on formatting, including mathematical notations/equations, and auto-referencing.