BS Engineering Technology/ Industrial Engineering Technology

College of 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 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 nonprofit sectors, and promotes economic development and enrichment of the communities we serve.

Industrial Engineering Technology Mission Statement: The mission of BS in Industrial Engineering Technology 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.

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 academic cycle (AC) 2020-2021 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 are not met, actions plans were devised and will be implement 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 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).

Measure 1.1. Every spring semester, students are graded based on rubric on their ability to design and solve rotary table for manufacturing facilities in IET 4700. The acceptable target is 80% of students score at least 9 out of 12 on rubric-based assessment on assignment.

Finding: Target was met.

Analysis: In AC 2019-2020, the target was met. Based on the analysis of the AC 2019-2020 results, the faculty implemented the following changes in AC 2020-2021 to drive the cycle of improvement. Due to the COVID-19 restrictions, in the last assessment cycle, this assessment was done on an individual basis rather than as the planned team project approach. In this cycle, the timed team project format to the project was reimplemented instead of the individual project assignment.

In AC 2020-2021, 21/26 (81%) of the students scored at least 9/12 (75%) on a rubric-based assessment on assignment on “design and solve rotary table for manufacturing facilities”.

Decision: Based on the results of AC 2020-2021, the faculty will implement the following changes in AC 2020-2021 to drive the cycle of improvement. Teams will be assigned by the instructor to level off the team strength and all members are mandatorily required to complete practice projects individually before the team project.

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 rated at least 80 out of 100 on checklist-based assessment of the technical portion of the project report.

Finding: Target was met.

Analysis: In AC 2019-2020, the target was not met. Based on the analysis of 2019-2020 results, in AC 2020-2021 the faculty made the following changes. Two separate subsections – “Assumptions Made” and “Project Constraints” were made mandatory under the “Methodology” section of the report. Equations and calculations were made mandatory in the report and were required to follow proper writing style (IEEE or APA with consistency). Pertinent literature was required to be cited (within the text and the reference section).

In AC 2020-2021, the target was met. During that AC, 2020-2021 22 out of 22 (100%) students were rated at least 80 out of 100 on checklist-based assessment of the technical portion of the project report.

Decision: Based on the analysis of the AC 2020-2021 results, the following changes will be made to drive the cycle of continuous improvement. The template for the final project report will be revised and will be made available for students in the learning management system (Moodle). It will include a separate section – titled "Scope of the Project" which is under the "Introduction" section of the report. Two separate subsections – "Assumptions Made" and "Project Constraints" – will be added under the "Methodology" section of the report. Examples of in-text citation for an equation as well as the format of equation placement in the body of the text will be added. The inclusion of pertinent appendices in the report will be encouraged to include relevant calculations (technical and budgetary). These changes will improve the students' ability to articulate technical information and solutions in written format, etc., thereby continuing to drive the cycle of continuous improvement.

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

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

Finding: Target was met.

Analysis: In AC 2019-2020, the target was met. Based on the analysis of the AC 2019-2020 results, the faculty implemented the following changes in AC 2020-2021 to drive the cycle of improvement. The instructor asked for feedback from the students regarding project status, progress in data collection, and report writing before the project submission due date. In addition to this, the instructor emphasized project expectations, explained the grading rubrics, and provided a complete template of the report to the students at the time of the project assignment.

As a result of these changes in AC 2020-2021, the target was met. 25 out of 30 (83%) of the students scored at least 12 out of 16 (75%) on a rubric-based assessment of a group assignment. Due to the COVID-19 pandemic, the course was offered in online-delivery format, as well as group projects. Physical visits to the industry were not feasible. Hence, unlike the previous year (AC 2019-2020), this year a "time study" semester project was assigned to the individual student based on some recorded video clips of the assigned workstation(s) imitating virtual visits to the industry. It was observed that some students did not collect additional information for a better explanation of the design improvement, and some students had a minor error(s) in the calculation for "total standard time".

Decision: Based on the analysis of the AC 2020-2021 results, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of improvement. The instructor of IET 3510 will, (1) encourage to collect relevant additional information for a better explanation of the design improvement, and (2) emphasize more in the calculation part

to ensure all results being correct in the students' reports.

Measure 2.2. Every spring semester, students are graded on an assignment creating, analyzing, and interpreting control charts for variables or attributes in IET 4720 to assess the attainment of SLO 2. The acceptable target is 80% of students score at least 75% (9 out of 12 or 12 out of 16) on the rubric-based assessment on assignment.

Finding: Target was met.

Analysis: In AC 2019-2020, the target was not met. Based on the analysis of AC 2019-2020, the instructor implemented the following changes in AC 2020-2021 to drive the cycle of continuous improvement. Faculty produced and posted video instructions showing control charts and their calculations that were similar to the assignment. Students were provided with additional examples. Faculty did not specify specific software to be used for the assignment; however, excel templates were made available to the student in the learning management system (Moodle). Free hand calculations were also accepted for this assignment.

As a result of these changes in AC 2020-2021, the target was met. 20 out of 24 (83%) of the students scored at least 12 out of 16 (75%) on a rubric-based assessment on the assignment on control charts for variables.

Decision: Based on the analysis of the AC 2020-2021 results, and to drive the cycle of continuous improvement for AC 2021-2022, the instructor will implement the following changes. The instructor will develop a step-by-step procedure with examples, to show how similar problems are solved and put it in the learning management system (Moodle) for students to access and practice. In addition, students will be provided with information regarding when to use which procedure to calculate standard deviation based on the chart type and sample size.

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

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

Finding: Target was met.

Analysis: In AC 2019-2020, the target was met. Based on the analysis of the AC 2019-2020 results, the faculty implemented the following changes in AC 2020-2021 to drive the cycle of improvement. These changes included (1) providing a complete template and guideline of the report with all necessary subject matters and (2) explaining the

grading rubrics to the students at the time of project assignment. The instructor also presented multiple examples of ergonomics in action in the workplace. The instructor held consultation sessions to help students successfully complete their assignments.

As a result of these changes, in AC 2020-2021 the target was met. 27 out of 30 (90%) students scored at least 12 out of 16 (75%) on the rubric-based assessment. Due to the COVID-19 pandemic, some students had limited access to the lab facilities and internet.

Decision: Based on the analysis of the AC 2020-2021 results, in AC 2021-2022, the faculty will implement the following changes. Students will be encouraged to be more specific in identifying the ergonomic requirements. Some examples will be given in the class to explain the expectations from the students in this regard. Also, students will be encouraged and provided with few examples to ensure that they present sufficient evidence, logic and/or theoretical background with reference to the appropriate ergonomic principle(s).

Measure 3.2. Every spring semester, students are graded on a timed assignment on warehouse lighting project in IET 4700 to assess the attainment of SLO 3. The acceptable target is 80% of students score at least 9 out of 12 (75%) on the rubric based assessment on assignment.

Finding: Target was met.

Analysis: In AC 2019-2020, the target was met. Based on the analysis of AC 2019-2020 results, the faculty modified the project parameters to represent a higher level of rigor in the project. Despite the pandemic, punctuality in the virtual classroom was emphasized, and the project was returned to its original team-based format.

In AC 2020-2021, 26/26 (100%) of the students scored at least 9 out of 12 on the rubric-based assessment on the warehouse lighting project.

Decision: Based on the analysis of the AC 2020-2021 results, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of continuous improvement. An individual practice assignment will be given to the students before this assignment to sustain the level of the results achieved in this cycle.

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 in 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 2019-2020, the target was met. Based on the analysis of the AC 2019-2020 results, in AC 2020-2021 all groups were required to use Microsoft Teams (or similar software) for the projects related communication including sharing files and other pertinent information. Team member roles were discussed stressing the importance of proper communication for team members and delegation for team leaders.

As a result of these changes, in AC 2020-2021 the target was again met. In AC 2020-2021, 18 out of 22 (82%) of the students were rated at least 20 out of 25 (80%) on the checklist-based peer-review survey. Due to the COVID-19 pandemic, this course was offered in an online delivery format.

Decision: Based on the analysis of the AC 2020-2021 results, and to drive the cycle of improvement, the following changes will be applied in AC 2021-2022. Each member of the team will have to submit their monthly progress report on their tasks delegated by the team leader and submit it to the instructor. Each team leader will have to submit the team member status report for each member at the end of every month. The instructor will have one on one meeting with the specific team member as on required basis based on feedback from the team.

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 on a checklist-based survey.

Finding: Target was met.

Analysis: In AC 2019-2020, the target was met. Based on the analysis of the AC 2019-2020 results, a mid-year peer evaluation was introduced. This evaluation was a confidential survey administered to every student in which they assessed peers' performance concerning their project requirements.

As a result of this change, in AC 2020- 2021, the target was met again. 20 out of 22 (91%) of the students met the criteria.

Decision: Based on the analysis of the AC 2020-2021 results, and to drive the cycle of improvement, the faculty will implement the following changes in AC 2021-2022. A team reflection paper on their experience from the previous semester in Project Design I, will be due within a couple of weeks into the Project Design II semester. It should include not only a collection of their individual experiences but also a summary of questions, comments, suggestions, and concerns expressed by the participants in the audience during the project proposal presentation. The revised plan to complete the project successfully will also be required to be described in a separate section within the same report. This should give the instructor an insight into which students need further

attention regarding be a well-prepared team member.

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

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

Finding: Target was met.

Analysis: In AC 2019-2020, the target was not met. Based on the analysis of AC 2019-2020 results, in AC 2020-2021 it was made mandatory for every group to participate in the mock presentation. These presentations were graded on the aspect of commitment to continuous improvement and professionalism.

As a result of the changes, in AC 2020-2021, the target was met. In AC 2020-2021, 22 out of 22 (82%) of the students were rated at least 80 out of 100 (80%) on the checklist-based assessment on an oral presentation by the ET faculty. Every group participated in the mock presentation and addressed the feedback in their presentation slides as well as in the final report.

Decision: Based on the analysis of the AC 2020-2021 results, and to drive the cycle of improvement, faculty will implement the following changes in AC 2021-2022. It will be mandatory for all groups to prepare each section of the oral presentation slides as the course progresses, not only at the end of the semester to establish a continuous feedback process. The mock presentations will be continued and will be used to test the project-related knowledge of every individual member of the team. This will be a separate graded assignment starting AC 2021-2022.

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 attainment of SLO 5. The acceptable target is 80% of IET students rated at least 80 out of 100 on checklist-based assessment of the written project report.

Finding: Target was met.

Analysis: in AC 2019-2020, the target was not met. Based on the analysis of the AC 2019-2020 results, in AC 2020-2021 all groups were required to submit a mid-semester project report adhering to the guidelines. The faculty provided feedback on the quality of the contents and formatting of the report. The faculty also provided feedback on the

quality of the contents and formatting of the final draft at least two weeks before the due date to provide students ample time for addressing changes and comments.

In AC 2020-2021, 22/22 (100%) of the 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 2020-2021 results, and to drive the cycle of improvement, the following changes will be implemented in AC 2021-2022. Faculty will meet with each group at least once every two weeks for a face-to-face meeting which had not been possible because of the pandemic. One of the additional agendas for this meeting will be to aid students in any difficulty they are experiencing in preparing reports related to figures, charts, formatting, writing style, and editing the documents. If any deficiencies present themselves, during these bi-weekly meetings, they will be addressed immediately instead of during the last two weeks of the semester when the final report is being written.

Comprehensive Summary of the Key Evidence (AC 2020-2021).

The following section outlines the comprehensive summary of actions taken to drive continuous improvement towards the attainment of students learning outcomes taken in AC 2020-2021 based on the analysis of the AC 2019-2020 results.

- In IET 3510 (SLO 2), the faculty started collecting feedback from the students regarding semester project status well before the project submission due date. The instructor enumerated project expectations and provided a complete template for the project report.
- In IET 3510 (SLO 3) guidelines of the report were provided to students for the assignment. Additionally, grading rubrics were explained to the students. More examples of ergonomics in action in the workplace were provided. Multiple consultation sessions were held by the instructor.

- In EET 4940, all groups were required to use Microsoft Teams (or similar software). Team member roles were discussed as well as the need for delegation by the team leaders.

- In EET 4940, it was made mandatory for every group to participate in the mock presentation. These presentations were graded on the aspect of commitment to continuous improvement and professionalism.

- In IET 4700 (SLO 1), the timed team project format to the project was reimplemented instead of the individual project assignment.

- In IET 4700 (SLO 3), the faculty modified the project parameters to represent a higher level of rigor in the project. Punctuality in the virtual classroom was emphasized, and the project was returned to its original team-based format.

- In IET 4960 (SLO 1), two separate subsections – “Assumptions Made” and “Project Constraints” were made mandatory under the “Methodology” section of the report. Equations and calculations were made mandatory in the report and were required to follow proper writing style and citation.

- In IET 4960 (SLO 4), a mid-year peer evaluation was introduced. This evaluation was a confidential survey administered to every student in which they assessed peers’ performance concerning their project requirements.

- In IET 4960 (SLO 5), all groups were required to submit a mid-semester project report adhering to the guidelines. Faculty provided feedback on the quality of the contents and formatting of the final draft at least two weeks before the due date to provide students ample time for addressing changes and comments.

- In IET 4720, the faculty produced and posted video instructions showing control charts and their calculations with some examples similar to the assignment. The faculty did not specify specific software to be used for the assignment; however, excel templates were made available to the student in the learning management system (Moodle). Freehand calculations were also accepted for this assignment.

Plan of action moving forward

As a part of continuous improvement, the following action plans were identified for AC 2021-2022.

- The instructor of IET 3510 (SLO 2) will, encourage the collection of relevant additional information to better explain the design improvement, and will emphasize more in the calculation of the results for accuracy.

- In IET 3510 (SLO 3), students will be encouraged to be more specific in identifying the ergonomic requirements, provide sufficient evidence, logic, and/or theoretical background in their ergonomics-based assignment.

- In EET 4940, it will be mandatory for all groups to prepare each section of the oral presentation slides as the course progresses. During the mock presentation, each individual will be assessed on project-related knowledge and a separate graded item will be added to the syllabus.

- In EET 4940, each member of the team will have to submit their monthly progress report. Each team leader will have to submit a monthly team member status report. The instructor will hold one on one meeting with the specific team member as on required basis.

- In IET 4700 (SLO 1), teams will be assigned by the instructor to level off the team strength and all members are mandatorily required to complete practice projects individually before the team project.

- In IET 4700 (SLO 3) an individual practice assignment will be given to the students before this assignment to sustain the level of the results achieved this cycle.

- In IET 4960 (SLO 1), the template for the final project report will be revised and will be made available for students. This report template will include two subsections – “Assumptions Made” and “Project Constraints” under the “Methodology” section, and a separate section – titled “Scope of the Project”. Examples of in-text citation for an equation as well as the format of equation placement in the body of the text will be added. The inclusion of pertinent appendices in the report will be encouraged to include relevant calculations.

- In IET 4960 (SLO 4), a team reflection paper on their experience from the previous semester in Project Design I, will be due within a couple of weeks into the Project Design II semester. It should include, a collection of their individual experiences, a summary of questions, comments, suggestions, and concerns expressed by the participants in the audience during the project proposal presentation. The revised plan to complete the project successfully will also be required to describe in a separate section within the same report.
- In IET 4960 (SLO 5), faculty will meet with each group at least once every two weeks for a face-to-face meeting which had not been possible because of the pandemic. One of the additional agendas for this meeting will be to aid students in any difficulty they are experiencing in preparing reports related to figures, charts, formatting, writing style, and editing the documents. If any deficiencies present themselves, during these bi-weekly meetings, they will be addressed immediately.

- In IET 4720, the instructor will develop a step-by-step procedure with examples, to show how similar problems are solved and put it in the learning management system (Moodle) for students to access and practice. In addition, students will be provided with information regarding when to use which procedure to calculate standard deviation based on the chart type and sample size.