Assessment Cycle 2021-2022

Program: Bachelor of Science (BS) Electronics Engineering Technology (141)

College: Arts and Sciences

Prepared by: Chen/Islam/Ali **Date: 06/01/2022**

Approved by: Jafar F. Al-Sharab **Date: 06/01/2022**

Approved by: Dr. Francene Lemoine, Dean **Date: 06/20/2022**

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 non-profit sectors and promotes economic development and enrichment of the communities we serve.

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

Purpose: The Bachelor of Science in electronics engineering technology will prepare students to: 1) analyze, test, build, operate, and maintain electronic systems, and 2) manage, maintain, and install low voltage/power systems, automation, and controls. These skills prepare 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 Electronics 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 Electronics Engineering Technology degree program. Measures used to collect data include reports, case studies, projects, exams, presentations, and written exercises. Assessment data for academic year 2020-2021 show that targets were met or exceeded and, in some case, not met. 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 for implementation 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 engineering problems appropriate to the discipline (ETAC of ABET Outcome 1).

Course Map: Tied to the course syllabus objectives

EET 3340: Advanced Electronics
EET 4310: Communication Electronics

Measure 1.1. Every spring semester, students in EET 3340 are graded using rubricson their ability to design Integrator Circuits. The acceptable target is 80% of students score 12 out of 16 (75%) on rubric-based assessments of their projects.

Finding: Target was met.

Analysis: In AC 2020-2021 the target was met. Based on the analysis of the AC 2020-2021 results, the instructor guided face-to-face students to first perform theoretical design and analysis of circuits using Algebra and Calculus and then using the MultiSim simulation program to verify their calculations experimentally.

As a result of these changes, in AC 2021-2022, the target was met. In AC 2021-2022, 7 out of 8 (88%) students scored at least 12 out of 16 (75%) on rubric-based assessmenton of the integrator circuit. The results showed improvement in AC 2021-2022 which can be attributed to the implemented changes in AC 2021-2022.

Decision: Based on the analysis of AC 2021-2022, the faculty will implement the following changes in AC 2022-2023 to drive the cycle of improvement. The instructor will design more comprehensive projects in integrator circuits, which can be found in the real-life industrial applications such as multiple access Code Division Multiple Access (CDMA) cell phones.

Measure 1.2. Every fall semester, students in EET 4310 are graded using rubrics ontheir ability to design Frequency Modulation (FM) receivers. The acceptable target is 80% of students scoring 9 out of 12 (75%) on the rubric-based assessment of their semester project.

Finding: Target was met.

Analysis: In AC 2020-2021 the target was met. Based on the analysis of the AC 2020-2021, the faculty made the following changes in AC 2021-2022 to drive the cycle of improvement. The instructor adopted a new textbook that included topics on FM communication. The instructor introduced newer concepts and materials. Students were provided with the resources such as PowerPoint presentations (during class lectures and for their independent study). The combination of solving problems on the board augmented with PowerPoint were used.

As a result of these changes, in AC 2021-2022, the target was met. In AC 2021-2022, 15 out of 15 (100%) students scored at least 9 out of 12 (75%) on the rubric-based assessment of their assignment on design of FM receivers.

Decision: Based on the analysis of AC 2021-2022, the faculty will implement the following changes in AC 2022-2023 to drive the cycle of improvement. The instructor will mandate students submit written status reports on their semester projects at the end of the 11^{th} week. The instructor will give feedback to students based on these interim reports. Instructors will send a reminder email to students about the upcoming deadline of the semester project two weeks before the due date and to submit the final semester report. These changes will improve the students' ability to complete the semester project on or before the due date thereby continuing to push the cycle of improvement forward.

SLO 2. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes (ETAC of ABET Outcome 4).

Course Map: Tied to the course syllabus objectives

EET 3341: Advanced Electronics Laboratory
EET 4311: Communication Electronics Laboratory

Measure 2.1. Every spring semester, students in EET 3341 are graded using rubricson their ability to design Op-Amp Circuits. The acceptable target is 80% of students scoring 12 out of 16 (75%) on rubric-based assessment of their projects.

Finding: Target was met.

Analysis: In AC 2020-2021 the target was not met. Based on the analysis of the AC 2020-2021 results, the instructor put more emphasis on the skills/knowledge required to reach the solution on amplifier, adder, integrator, and differentiator problems. The instructor performed face-to-face teaching of the experiments. The instructor spent more time on the explanation of the relevant mathematics behind the theory and demonstrated the lab procedures. Students were provided with additional exercises to help their understanding of the concepts and methods related to the actual lab assignments.

Because of these changes in AC 2021-2022, the target was met. In AC 2021-2022, 7 out of 8 (88%) students scored at least 12 out of 16 (75%) on rubric-based assessment of lab assignments on the analysis and design of op-amps circuits.

Decision: Based on the analysis of AC 2021-2022, the faculty will implement the following change in AC 2022-2023 to drive the cycle of improvement. In AC 2022-2023, the instructor will illustrate more troubleshooting techniques such as half-splitting method. This change will improve the students' ability to troubleshoot op-amp circuits more efficiently.

Measure 2.2. Every fall semester, students in EET 4311 are graded using rubrics on their ability to design FM Modulator. The acceptable target is 80% of students scoring9 out of 12 (75%) on rubric-based assessment of projects.

Finding: Target was met.

Analysis: In AC 2020-2021 the target was met. Based on the results of the AC 2020-2021 assessment, in AC 2021-2022, the following strategies were implemented to drive the cycle of improvement. The instructor continued the practice of pre-lab briefings which included safety items. The instructor administered an informal survey to students regarding their experience and the any difficulty the experienced while carrying out lab assignments to understand what could facilitate their learning during the lab exercises.

As a result of these changes **i**n AC 2021-2022, the target was met. 15 out 15 (100%) of the students scored at least 9 out of 12 (75%) on rubric-based assessment of FM Modulator design. The timing of the lab was towards the end of the semester and the students had no problems handling the increased technical rigor of the lab.

Decision: Based on the analysis of AC 2021-2022, the faculty will implement the following changes in AC 2022-2023 to drive the cycle of improvement. In AC 2022-2023, the instructor will put more emphasis on the skills/knowledge required to reach the solution of FM modulator design problems. Students should submit a rough draft of this important lab project to obtain feedback from their instructor. This will provide an opportunity to students to take corrective actions on their data collection, tests, measurements, and experiments, analysis, and interpretation. These changes will improve the students' ability to complete the lab report on or before the due date thereby continuing to push the cycle of improvement forward.

SLO 3. An ability to design systems, components, or processes meeting specified needs for broadly defined engineering problems appropriate to the discipline (ETAC of ABET Outcome 2).

Measure 3.1. Every fall semester, students in EET 4311 are graded using rubrics on their ability to design Amplitude Modulation (AM) Modulator. The acceptable target is 80% of students scoring 9 out of 12 (75%) on rubric-based assessment of laboratory assignment.

Finding: Target was met.

Analysis: In AC 2020-2021 the target was met. Based on the results of the AC 2020-2021 assessment, in AC 2021-2022, the following strategies were implemented to drive the cycle of improvement. The instructor reviewed the handout and made changes emphasizing design aspects of the AM modulator to calculate the maximum and minimum voltages of the AM envelope and to measure it from the output AM waveform of the designed circuit. The instructor gave pre-lab briefings (including safety) and a standardized format for the formal laboratory report. As a result of these changes, in AC 2021-2022, the target was met. In AC 2021-2022, 15 out 15 (100%) of the students scored at least 9 out of 12 (75%) on rubric-based assessment of AM Modulator design.

Decision: Based on the analysis of AC 2021-2022, the faculty will implement the following changes in AC 2022-2023 to drive the cycle of improvement. The instructor will first prepare students for this lab by introducing the concepts on AM modulator circuits in the theory class (EET 4310) before assigning the lab exercise. The rigor of the project will also be increased by including design components for high powered AM Modulator.

Measure 3.2. Every spring semester, students in EET 4351 are graded using rubricson their ability to design Two-way Traffic Controllers with Programmable Logic Controller (PLCs). The acceptable target is80% of students scoring 9 out of 12 (75%) on rubric-based assessment of project.

Finding: Target was met.

Analysis: In AC 2020-2021 the target was met. Based on the results of the AC 2020-2021 assessment, in AC 2020-2021, the following strategies were implemented to drive the cycle of improvement. Students were advised to learn the applications of various

instructions needed to develop the PLC program within ten weeks and dedicate the rest of the semester for completing and testing the project. In addition to extra time in the laboratory by the instructor, the entire lab time in the final week was dedicated to completing the final project.

As a result of these changes in AC 2021-2022, the target was met. In AC 2021-2022, 14 out of 15 students (93%) of the students scored at least 9 out of 12 (75%) on rubric-based assessment of the project "Design of Two-way Traffic Controllers using PLCs."

Decision: Based on the analysis of AC 2021-2022, the faculty will implement the following changes in AC 2022-2023 to drive the cycle of improvement. The project will also implement timers and counters in the revised project requirements. The instructor will also make grammar and spell check mandatory for the laboratory project report. These changes will broaden the students' ability to implement new devices using PLCs thereby continuing to push the cycle of improvement forward.

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

Course Map: Tied to the course syllabus objectives

EET 3361: Instrumentation and Control Laboratory
EET 4940: Project Design I
EET 4950: Project Design II

Measure 4.1. Every spring semester the instructor of the course rates students in EET 4950 based on their ability and skill as a member or a leader of the team using a checklist-based review survey. The instructor will use the overall impression of the team based on asemester long interaction with the team to rate the members and leaders. The acceptable target is 80% of students are rated at least 20 out of 25 on the checklist-basedsurvey.

Finding: Target was met.

Analysis: In AC 2020-2021 the target was met. Based on the analysis of AC 2020-2021 results,the faculty made the following changes in AC 2021-2022. Clearly defined roles and responsibilities of the team members as well as the leader of the team were developed,distributed, and explained to the students at the beginning of the semester. Communicationchannels (proper procedure) were established for the team members to notify instructor of any conflicts in the group and/or stagnancy in project progress so that the instructor can mediate the situation in a timely manner.

As a result of these changes, in AC 2021-2022 the target was met. Ten out of eleven (91%) of the students were rated at least 20 out of 25 (80%) on checklist-based peer review survey.

Decision: In AC 2021-2022, the target was met. Based on the analysis of AC 2021- 2022, the faculty will implement the following changes in AC 2022-2023 to drive the cycleof

improvement. The students will be reminded weekly about the importance of teamwork in real-life (industry environments) as recommended by the IAC (Industry Advisory Committee) members. Communication channels (proper procedure) will be established for the team members to notify their instructor of any conflicts that developed within the group including any situation that has caused projects to reach a standstill. All groups will be required to use Microsoft Teams or similar software for the projects. This will allow them to learn and experience how to be an effective member or leader of a technical project team.

Measure 4.2. Every spring semester, students in EET 3361 assess their peers in a technical team with respect to 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 EET students are rated at least 20 out of 25 on checklist-based peer review survey.

Finding: Not Assessed.

Analysis: This course has been moved from spring to fall semester as a result of curriculum revision.

Decision: Going forward, this SLO will be assessed in EET 4940 (Project Design I). Measure 4.2 will be assessed every fall semester. Students in EET 4940 will assess their peers in a technical team with respect to 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 EET students are rated at least 20 out of 25 (80%) on checklist-based peer review survey.

SLO 5. 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 (ETAC of ABET Outcome 3).

Course Map: Tied to the course syllabus objectives

EET 4940: Project Design I
EET 4950: Project Design II

Measure 5.1. Every fall semester, students in EET 4940 assess their peers in a technical team with respect to their ability and skill as a member or a leader of the teambased on a checklist-based peer review survey. The acceptable target is 80% of EET students are rated at least 20 out of 25 (80%) on checklist-based peer review survey.

Finding: Target was met.

Analysis: In AC 2020-2021 the target was met. Based on the analysis of AC 2020- 2021 results, the faculty made the following changes in AC 2021-2022 to drive the cycle of improvement. The leader of each team was asked to check whether there were any conflicts among the team members. In AC 2021-2022, no serious complaints were recorded.

As a result of the changes, in AC 2021-2022, the target was met. In AC 2021-2022,15 out of 15 (100%) of the students were rated at least 20 out 25 (80%) by their peers on checklist-based assessment in peer review surveys.

Decision: Based on the analysis of AC 2021-2022, the faculty will implement the following changes in AC 2022-2023 to drive the cycle of improvement. The leaders of all groups will now be required to submit a written report on any conflicts among their team members after an internal effort to resolve the conflict is unsuccessful. The instructor will then immediately discuss the teams' non-cohesive situation. The instructor will make it clear that the continued unrest and unprofessionalism will be reflected in each team member's final grade. It is believed that this negative reinforcement will work to promote better team dynamics thereby continuing to push the cycle of improvement forward.

Measure 5.2. Every spring semester, upon submission of capstone project reports in EET 4950, 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 EET students are rated at least 80 out of 100 (80%) on checklist-based assessment of the written project report.

Finding: Target was met.

Analysis: In AC 2020-2021, the target was met. The faculty made the following changes in in AC 2021-2022 to drive the cycle of improvement. The students were required to submit the draft report three weeks before the final presentation. Then, the faculty provided feedback on the quality of the contents and formatting of the final draft at least two weeks before the due date to ensure the students had ample time for addressing changes and comments.

As a result of the changes in AC 2021-2022, the target was met. In AC 2021-2022, the overall results were that 11 out of 11 (100%) of the students were rated at least 80 out 100 (80%) on the checklist-based assessment of the written project report.

Decision: Based on the analysis of AC 2021-2022, the faculty will implement the following changes in AC 2022-2023 to drive the cycle of improvement. To ensure that the students have made the required corrections in the project reports as indicated by the instructor and other faculty reviewers, they must submit it to the instructor for one final review by the instructor before the final submission. This will allow them to learn commitment to quality and improvement on technical report preparation thereby continuing to push the cycle of improvement forward.

Comprehensive Summary of Key evidence of seeking improvement based on the analysis of the results. The following reflects all the changes implemented to drive the continuous process of seeking improvement in AC 2021-2022. These changes are based on the knowledge gained through the analysis of AC 2020-2021 results.

- The instructor guided face-to-face students to first perform theoretical design and analysis of circuits using Algebra and Calculus and then used MultiSim simulation

program to verify their calculations experimentally.

- The instructor adopted a new textbook that included topics on FM communication. The instructor introduced newer concepts and materials. Students were provided with the resources such as PowerPoint presentations (during class lectures and for their independent study). The combination of solving problems on the board augmented with PowerPoint were used.

- The instructor put more emphasis on the skills/knowledge required to reach the solution on amplifier, adder, integrator, and differentiator problems. The instructor performed face-to-face teaching of the experiments. The instructor spent more time on explanation of the relevant mathematics behind the theory and demonstrated the lab procedures. Students were provided with additional exercises to help their understanding of the concepts and methods related to the actual lab assignments.

- The instructor continued the practice of pre-lab briefings which included safety items. Theinstructor administered an informal survey to students regarding their experience and any difficulty the experienced in carrying out lab assignments to understand what could facilitate their learning during the lab exercises.

- The instructor reviewed the handout and made changes emphasizing design aspects of the AM modulator to calculate the maximum and minimum voltages of the AM envelope and to measure it from the output AM waveform of the designed circuit. The instructor continued the practice of pre-lab briefing (including safety) and a standardized format for the formal laboratory report.

- Students were advised to learn the applications of various instructions needed to develop the PLC program within ten weeks and dedicate the rest of the semester for completing and testing the project. In addition to extra time of help in the laboratory by the instructor, the entire lab time in the final week was dedicated to finish the final project.

- Clearly defined roles and responsibilities of the team members as well as the leader of the team were developed,distributed, explained to the students at the beginning of the semester. Communication channels (proper procedure) were established for the team members to notify the instructor of any conflicts in the group and/or stagnancy in project progress so that the instructor can mediate the situation in a timely manner.

- The leader of each team was asked to check whether there were any conflicts among the team members.

- The students were required to submit the draft report three weeks before the final presentation. Then, the faculty provided feedback on the quality of the contents and formatting of the final draft at least two weeks before the due date to ensure the students have ample time for addressing changes and comments.

Plan of action moving forward:

- The instructor will design more comprehensive projects in integrator circuits, which will be found in the real-life industrial applications such as multiple access CDMA cell phones.
- The instructor will mandate students submit written status reports on semester project at the end of the 11th week. The instructor will give feedback to students based on these interim reports. Instructors will send a reminder email to students about the upcoming deadline of the semester project two weeks before the due date and to submit the final semester report.
- The instructor will illustrate more troubleshooting techniques such as half-splitting method. This change will improve the student's ability to troubleshoot op-amp circuits more efficiently.
- The instructor will put more emphasis on the skills/knowledge required to reach the solution of FM modulator design problems.
- The instructor will ask students to submit a rough draft of this important lab project to have feedback from the instructor. This will provide an opportunity to students to take corrective actions on their data collection, tests, measurements, and experiments, analysis, and interpretation.
- The instructor will assign projects on timers and counters in the revised project requirements. The instructor will also make grammar and spell check mandatory for the laboratory project report.
- The students will be reminded weekly about the importance of teamwork in real-life (industry environments) as recommended by the IAC (Industry Advisory Committee) members. Communication channels (proper procedure) will be established for the team members to notify instructor of any conflicts that developed within the group including any situation that has caused project to reach a standstill. All groups will be required to use MS Teams or similar software for the projects.
- SLO4 will be assessed in EET 4940 (Project Design I). The Measure 4.2 will be assessed every fall semester. Students in EET 4940 will assess their peers in a technical team with respect to their ability and skill as a member or a leader of the team based on a checklist-based peer review survey.
- The leaders of all groups will now be required to submit a written report on any conflicts among their team members after an internal effort to resolve the conflict is unsuccessful. The instructor will then immediately discuss the teams' non-cohesive situation. The instructor will make it clear that the continued unrest and unprofessionalism will be reflected in each team member's final grade.
- The instructor will ensure that the students have made the required corrections in the project reports as indicated by the instructor and other faculty reviewers, they must submit it to the instructor for one final review by the instructor before the final submission. This will allow them to learn commitment to quality and improvement on technical report preparation thereby continuing to push the cycle of improvement forward. Faculty will provide more detailed guidelines about formatting of the semester project report. They will first prepare students with lab exercises before assigningthe semester project.

- The rigor of the project will be increased, so labs will cover necessary concepts and theory to successfully complete the semester project.
- Faculty will emphasize the practice of using grammar and spell check for the laboratory project report. They will post the project by the end of third week orearlier in the Moodle.
- Faculty will inquire about the use of lab fees to purchase off-campus software foraccelerating the process of completion.
- Communication channels (proper procedure) will be established for the team members to notify instructor of any conflicts in the group and/or stagnancy in project progress so that the instructor can mediate the situation in a timely manner. All groups will be required to use MS Teams or similar software for the projects.
- The ET department will write grants to acquire funding to buy hardware and software for students to build practical control systems. With this equipment, the instructor will ask students to work on the design and analysis of control systems.
- The instructor will ask students to apply computer software such as MATLAB, Simulink, and Optimization Toolbox to design controllers and implemented with hardware.
- Students will be allowed to submit a rough draft of this important lab project to have instructor feedback. This process will be repeated twice before the final submission.
- All groups will now be required to participate in the mock presentation. Mock presentations will be graded, and students will be provided feedback by the faculty.
- All groups will now be required to submit a mid-semester project report adhering to the guidelines. This report will be a part of the midterm grade.