Engineering Technology (Electronics Engineering Technology, BS)

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.

Electronics Engineering Technology Mission Statement: The mission of BS in Electronics Engineering Technology 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 program 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. 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 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 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 engineering problems appropriate to the discipline (ETAC of ABET Outcome 1).

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

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 guided students to first perform theoretical design and analysis of circuits using Algebra and Calculus and then use MultiSim simulation program to verify their findings. The instructor designed comprehensive projects in integrator circuits. These projects enhanced the ability of students to design real-life application-based circuits.

As a result of these changes, in 2020-2021, the target was met. In AC 2020-2021, 19 out of 22 (86%) students scored at least 12 out of 16 (75%) on rubric based assessment on the integrator circuit. The results were slightly improved in AC 2020-2021 due to the measure taken by the instructor. However, the instructor found that some students tend to avoid mathematics once they know that a solution can be available from a computer simulation method.

Decision: Based on the analysis of AC 2020-2021, the faculty will implement the following changes in 2021-2022 to drive the cycle of improvement. The instructor will explain the advantages and limitations of the theoretical approach and MultiSim method. The instructor will request students to first perform theoretical design and analysis of circuits using Algebra and Calculus and then use MultiSim simulation program to verify their findings. The instructor plans to provide a step-by-step explanation of circuit analysis by using Algebra and Calculus. These changes will improve the student's ability to acquire necessary concepts to perform well in projects thereby continuing to push the cycle of improvement forward.

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).

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

Finding: Target was met.

Analysis: In AC 2019-2020 the target was met. Based on the analysis of the AC 2019-2020, the faculty made the following changes in 2020-2021 to drive the cycle of improvement. The instructor adopted a new textbook. The instructor introduced newer concepts and materials. Students were provided with the resources such as PowerPoint presentations (during class lectures and for their study). The combination of solving problems on the board augmented with PowerPoint were used.

As a result of these changes, in AC 2020-2021, the target was met. In AC 2020-2021, 12 out of 14 (86%) students scored at least 9 out of 12 (75%) on rubric-based assessment of assignment on design of FM receivers.

Decision: Based on the analysis of AC 2020-2021, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of improvement. Instructors will mandate students submit written status reports on semester project at the end of the 10^{th} week. Instructors will send a reminder email to students about the upcoming deadline of the semester project one week before the due date. These changes will improve the students' ability to complete 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).

Measure 2.1. Every spring semester, students in EET 3341 are graded based on rubrics on 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 projects.

Finding: Target was not met.

Analysis: In AC 2019-2020 the target was not met. Based on the analysis of the AC 2019-2020 results, the instructor put more emphasis on the skill/knowledge required to reach the solution on amplifier, adder, integrator, and differentiator problems. The instructor spent more time on explanation of the relevant mathematic behind the theory. Students were provided with more exercises to help their understanding of the concepts and methods related to lab assignments.

Despite these changes by the instructor, in AC 2020-2021, the target was slightly improved but not met. In AC 2020-2021, 17 out of 22 (77%) students scored at least 12 out of 16 (75%) on rubric-based assessment of lab assignment on the analysis and design of op-amps circuits.

Decision: Based on the analysis of AC 2020-2021, the faculty will implement the following changes in 2021-2022 to drive the cycle of improvement. In AC 2021-2022, the instructor will provide more flexibility to help those students who need to work extensively as a fulltime student. The instructor will explain in greater details on the skill/knowledge

required to reach the solution on amplifier, adder, integrator, and differentiator problems. The instructor will give more examples on applying algebra and calculus to analyze differentiation, integration, and amplification circuits. The instructor will email students to remind students to ensure that they finish their reports in time. These changes will improve the student's ability to acquire necessary concepts to perform well in designing assigned lab circuits in op-amp 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).

Measure 2.2. Every fall semester, students in EET 4311 are graded based on rubrics on their ability to design FM Modulator. The acceptable target is 80% of students scoring 9 out of 12 (75%) on rubric-based assessment of projects.

Finding: Target was not met.

Analysis: In AC 2019-2020 the target was met. Based on the results of the AC 2019-2020 assessment, in AC 2020-2021, the following strategies were implemented to drive the cycle of improvement. The instructor continued the practice of prelab briefings. The instructor administered an informal survey to students regarding their experience and the difficulty in carrying out lab assignments to understand what could enhance their learning during the lab exercises.

As a result of these changes**,** In AC 2020-2021, the target was met. Ten (10) out 14 (71%) 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.

Decision: Based on the analysis of AC 2020-2021, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of improvement. In AC 2021-2022, the instructor will put more emphasis on the skill/knowledgerequired to reach the solution of FM modulator design problems. The instructor will remind the students from very beginning about the FM modulator design project which is normally assigned six weeks before the end of the semester. The instructor will remind the students by email once the assignment is posted on Moodle. This process will be repeated after three weeks. These changes will improve the student's 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 based on rubrics on

their ability to design AM Modulator. The acceptable target is 80% of students scoring 9 out of 12 (75%) on rubric-based assessment of projects.

Finding: Target was met.

Analysis: In AC 2019-2020 the target was met. Based on the results of the AC 2019-2020 assessment, in AC 2020-2021, the following strategies were implemented to drive the cycle of improvement. The faculty reviewed the handout and made changes to the handwritten problems to enhance learning. The instructor of the course implemented a standardized format for the formal project report in the course. The instructor noted that the rigor of the project was apparently not challenging enough. Increasing the rigor was done by adding more constraints in the design parameters.

As a result of these changes, in AC 2020-2021, the target was met. In AC 2020-2021, 14 out 14 (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 2020-2021, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of improvement. The instructor will provide more detailed guidelines about formatting of the semester project report. The instructor will first prepare students with lab exercises before assigning the semester project. The rigor of the project will be increased, so these labs will cover necessary concepts and theory to successfully complete the semester project. The instructor will send a reminder email to students about the upcoming deadline one week before the due date. These changes will improve the student's ability to complete the semester project 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 3.2. Every spring semester, students in EET 4351 are graded based on rubrics on their ability to design Two-way Traffic Controllers with PLCs. The acceptable target is 80% of students scoring 9 out of 12 (75%) on rubric-based assessment of project.

Finding: Target was met.

Analysis: In AC 2019-2020 the target was not met. Based on the results of the AC 2019-2020 assessment, in AC 2020-2021, the following strategies were implemented to drive the cycle of improvement. Students were advised to learn the applications of instructions needed to be developing the PLC program within ten weeks and dedicate the rest of the semester time for completing and testing the project. In addition, extra time of help in the laboratory was offered to the students by the instructor.

As a result of these changes, in AC 2020-2021 the target was met. In AC 2020-2021, 12 out of 14 students (86%) of the students scored at least 9 out of 12 (75%) on rubric-

based assessment of the project to design Two-way Traffic Controllers with PLCs. The timing of the labs to help with understanding the project starts in the sixth week of the semester.

Decision: Based on the analysis of AC 2020-2021, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of improvement. The instructor will emphasize the practice of using grammar and spell check for the laboratory project report. The instructor will post the project by the end of third week or earlier in the Moodle. The students will be reminded several times to start and continue toward completion of the project. The instructor will inquire about the use of lab fees to purchase off-campus software for accelerating the process of completion. These changes will improve the student's ability to complete the semester project report on or before the due date 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).

Measure 4.1. Every spring semester, instructor of the course rates students in EET 4950 based on their ability and skill as a member or a leader of the team on a checklist-based review survey. 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 checklist-based survey.

Finding: Target was met.

Analysis: In AC 2019-2020 the target was met. Based on the analysis of AC 2019-2020 the faculty made the following changes in AC 2020-2021. 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 channel (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 2020-2021 the target was met as at least 80% of the students are rated at least 20 out of 25 on checklist-based peer review survey. In AC 2020-2021, 4 out of 5 (80%) of the students were rated at least 20 out of 25 on checklist-based peer review survey. The assessment methodology continued to be used to assess the ability and skill as a member or a leader of the team. The instructor kept open channels of communication with the team members in addition to the existing communication with the team leaders so that learning of the conflicts within the group late can be avoided.

Decision: In AC 2020-2021 the target was met. Based on the analysis of AC 2020-2021, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of improvement. The students will be reminded continuously the importance of the

teamwork in the real-life industry environments. 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. These changes will improve the student's ability in oral communication. This will allow them to learn and experience how to be an effective member or the leader of the technical project team.

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

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: Target was met.

Analysis: In AC 2019-2020 the target was met. Based on the analysis of AC 2019-2020 the faculty made the following changes in AC 2020-2021. The class was changed from online to onsite. The students were provided with necessary hardware and software.

As a result of these changes, in 2020-2021 the target was met. Nine (9) out of 10 (90%) students scored at least 20 out of 25 (80%) on check-list based peer reviewed survey. Students were expected to build real control systems in addition to perform theoretical analysis and computer simulation.

Decision: Based on the analysis of AC 2020-2021, the faculty will implement the following changes in 2021-2022 to drive the cycle of improvement. 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. These changes will help the student to perform effectively as a member or a leader of the technical team thereby continuing to push the cycle of improvement forward.

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).

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 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: Target was not met.

Analysis: In AC 2019-2020 the target was met. Based on the analysis of AC 2019-2020 the faculty made the following changes in in AC 2020-2021 to drive the cycle of improvement. There was a mock presentation before the actual presentation. Faculty feedback on PowerPoint slides and oral presentations were given before the actual presentation.

As a result of the changes, in AC 2020-2021, the target was not met. In AC 2020-2021, 13 out of 17 (76%) of the students rated at least 80 out of 100 on checklist- based assessment on oral presentation. This is the first time a new assessment methodology was used to assess ability to communicate effectively.

Decision: Based on the analysis of AC 2020-2021, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of improvement. 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. These changes will improve the student's ability in oral communication. This will allow them to learn proper technical report preparation following the accepted writing style thereby continuing to push the cycle of improvement forward.

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).

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

Finding: Target was not met.

Analysis: In AC 2019-2020 the target was met. The faculty made the following changes in in AC 2020-2021 to drive the cycle of improvement. A project team-leader

responsibility was communicated clearly to the team leaders. Work was equally distributed among the team members without overwhelming any team members.

As a result of the changes, in AC 2020-2021, the target was not met. In AC 2020-2021, the overall results were that 5 out of 5 (100%) of the students were rated at least 80 out 100 on the checklist-based assessment of the written project report. Communication among members was severely impacted by the COVID 19 pandemic.

Decision: Based on the analysis of AC 2020-2021, the faculty will implement the following changes in AC 2021-2022 to drive the cycle of improvement. 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. Faculty will provide feedback on the quality of the contents and the formatting of the report. The students will be required to check the grammar and spelling of the written report before submission. They will be reminded of looking into the responsibly of the team leader/members posted in Moodle several times in the semester. Faculty will also provide feedback on the quality of the technical contents and the formatting of the final draft at least three weeks before the due date to provide students ample time for addressing changes and comments. These changes will improve the student's ability in written communication. This will allow them to learn proper technical report preparation following the accepted writing style thereby continuing to push the cycle of improvement forward.

Comprehensive Summary of Key evidence of seeking improvement based on the analysis of the results. Program faculty made several decisions after examining results of data analysis from AC 2019-2020 which resulted in improved student learning and program improvement in AC 2020-2021.

- Faculty guided students to first perform theoretical design and analysis of circuits using Algebra and Calculus and then use MultiSim simulation program to verify their findings.
- Faculty designed comprehensive projects in integrator circuits.
- Faculty adopted a new textbook.
- Faculty introduced newer concepts and materials and students were provided with the resources such as PowerPoint presentations (during class lectures and for their study).
- Faculty put more emphasis on the skill/knowledge required to reach end solutions on amplifier, adder, integrator, and differentiator problems. Faculty spent more time on explanation of the relevant mathematic behind the theory. Students were provided with more exercises to help their understanding of the concepts and methods related to lab assignments.
- Faculty engaged in prelab briefings and administered an informal survey to students regarding their experience and the difficulty in carrying out lab assignments to understand what could enhance their learning during the lab exercises.

- Faculty implemented a standardized format for the formal project report in the appropriate course and the rigor was increased by adding more constraints in the design parameters.
- Students were advised to learn the applications of instructions needed to be developing the PLC program within ten weeks and dedicate the rest of the semester time for completing and testing the project. In addition, extra time of help in the laboratory was offered to the students by the instructor.
- 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 channel (proper procedure) were established between the team and faculty members.
- One class was changed from online to onsite. The students were provided with necessary hardware and software.
- There was a mock presentation before the actual presentation. Faculty feedback on PowerPoint slides and oral presentations were given before the actual presentation.
- A project team-leader responsibility was communicated clearly to the team leaders. Work was equally distributed among the team members without overwhelming any team members.

Plan of action moving forward.

- Faculty will explain the advantages and limitations of the theoretical approach and Multisim method. Faculty will provide a step-by-step explanation of circuit analysis by using Algebra and Calculus.
- Faculty will require students to first perform theoretical design and analysis of circuits using Algebra and Calculus and then use MultiSim simulation program to verify their findings.
- Instructors will mandate students to submit written status report on semester project at the end of the 10^{th} week. Instructors will send a reminder email to students about the upcoming deadline of the semester project one week before the due date.
- Faculty will explain in greater details on the skill/knowledge required to reach the solution on amplifier, adder, integrator, and differentiator problems. They will give more examples on applying algebra and calculus to analyze differentiation, integration, and amplification circuits.
- Faculty will put more emphasis on the skill/knowledgerequired to reach the solution of FM modulator design problems. Faculty will remind the students from very beginning about the FM modulator design project which is normally assigned six weeks before the end of the semester and send periodic reminders about the assignment.

- Faculty will provide more detailed guidelines about formatting of the semester project report. They will first prepare students with lab exercises before assigning the 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 or earlier in the Moodle.
- Faculty will inquire about the use of lab fees to purchase off-campus software for accelerating 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.
- 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.