County College of Morris

ACADEMIC OUTCOMES ASSESSMENT SUMMARY FORM

Please complete a separate form for each department and each program. Summary forms are due each year on June 15. Completed forms should be submitted electronically to Academicaffairs2@ccm.edu and to your division.

ACADEMIC YEAR: *2023 – 2024*
DEPARTMENT: *Engineering Technologies / Engineering Science*
PROGRAM: *P3700 Mechanical Engineering Technology including P5710 CAD Certificate, also Certificates of Achievement under MET*
SUBMITTED BY: *Y.N. Yiin*
PERSON RESPONSIBLE FOR ASSESSMENT: Y.N. Yiin

PART ONE

What was our plan? Describe the department/program assessment plan you employed over the past year.

The Program Outcome was assessed during the Fall 2023 and Spring 2024 semester. The five categories of the learning outcome were monitored collectively through four courses: Circuit Analysis DC/AC (ELT 100), Strength of Materials (MEC 141), Technical Physics (PHY 112), and Engineering Tech Project (ENR 240), and the timeline of the assessment is shown in Table 1.

Table 1

Program Learning Outcome	Course (s) Assessed	Timeline
1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	ELT 100, PHY112, MEC141, ENR240	Spring 2024
2. An ability to design solutions for well-defined technical problems and assist with engineering design of systems, components, or processes appropriate to the discipline.	MEC141, ENR240	Fall 2023
3. An ability to apply written, oral, and graphical communication in well-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.	MEC141, ENR240	Spring 2024
4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results.	ELT100, PHY112	Spring 2024
5. An ability to function effectively as a member of a technical team.	MEC141, ENR240	Fall 2023

How were these outcomes assessed?
Describe your department's assessment process including courses where the assessment occurs, a description of the assessment instrument, and identification of the instrument by type(s) as listed in 1 – 9 above.

The assessment instruments employed in each course to evaluate each of the learning outcome are indicated in Table2. Detailed descriptions of the assessment method used by each course are also provided herein.

Table 2

Learning Outcome	Course Assessed	Assessement Instrument			
		Rubric	Internally Developed Test	Lab Report	Portfolio/ Performance
1	ELT100		√		
	PHY112		√		
	MEC141		√	√	
	ENR240		√	√	
2	MEC141			√	√
	ENR240	√		√	√
3	MEC141			√	
	ENR240	√		√	
4	ELT100			√	
	PHY112			√	
5	MEC141			√	√
	ENR240	√			√

ELT 100 Assessment Process

The assessment employed in ELT 100 took place in the Spring 2024 semester.
Learning Outcomes were assessed using the information collected from the final exam and an example lab report. Student output from the exam was analyzed by each question and used as indicators for PLO 1. The grades from one example lab exercise were compiled and used as indicator for PLO 4. Each lab report was assessed based on report completeness, analysis of results, and appropriate conclusions.

The Expected Level of Achievement for the program was to have 70% of the students deliver a satisfactory output from the final exam and the lab report.

PHY 112 Assessment Process

The assessment employed in PHY 112 took place in the Spring 2024 semester.
Learning Outcomes were assessed via an internally developed test and lab activities. Student output from the test was analyzed by each question and used as indicators for PLO 1. Lab activities were assessed in the form of lab report. Report grades were assigned based on document completeness, analysis of results, and appropriate conclusions. Additionally, considerations were given for formatting and presentation. Grades of six lab reports were compiled and used as indicator for PLO 4.

The Expected Level of Achievement for the program was to have 70% of the students deliver a satisfactory output from the assessment test and the lab reports.

MEC 141 Assessment Process

The assessment employed in MEC 141 took place in the Fall 2023 semester.
Learning Outcomes were assessed using the information collected from the final exam and one example lab report. Student output from the exam was analyzed by each question and used as indicators for PLO 1. The lab report on tensile test experiment was used to assess PLO 2 to 5. The report was assessed based on the execution of experiment, report completeness, analysis of results, and appropriate conclusions.

The Expected Level of Achievement for the program was to have 70% of the students deliver a satisfactory output from the assessment test and the lab reports.

ENR 240 Assessment Process

The assessment employed in ENR 240 consisted of two parts; the final design projects from Fall 2023 were used to assess PLO 2 to 5 while the graduation exam given in Spring 2024 was used to assess PLO 1.

The final design project/competition is implemented as a summative assessment for the course, as well as a formative assessment of student's abilities thus far in the program. A rubric was used for assessment of the project and evaluated team performance (see Table 3-1). The rubric evaluated 6 key process gates in the project and aligned with a set deliverable timeline. The areas evaluated were:

- ✓ Design Phase (Brainstorm, Concept Selection, Research, Initial, and Final Design)
- ✓ Functional/Operational capabilities of the design
- ✓ Competition Performance
- ✓ Ability to foster, work in, and succeed in, a team environment.
- ✓ Presentation Skills
- ✓ Final Report

Team members would meet for weekly sessions during lab hours for individualized team meetings that would be "checked in" by the instructor. Students were required to independently meet deliverables according to a weekly schedule, culminating in the competition (aka data collection) and presentation of results. This was done in the form of a product pitch and encompassed an abridged version of the engineering design cycle. As the course is an analytical course, particular focus was given to their analysis and the decision making which arose from it.

The Rubric is provided on the following page.

Table 3-1. Rubric

SCORE	0	1	2	3	4	5
DESIGN PHASE (Bb SUBMISSIONS)	Completed none of the required Project Milestone Submissions	Completed some of the submissions but with little work/effort shown	Completed some of the submission with a minimal amount of support material	Completed some of the submission with an adequate amount of support material	Completed all of the required Project Milestone Submissions with adequate support	Completed all of the required Project Milestone Submissions with effort going above and beyond to be thorough
FUNCTION	Did not build the product; Did not provide a working, functional prototype	Partially built the product, on the road to implementing design; Does not function	Built the product according to designs and materials; Trebuchet fails to function; no firing mechanism	Built the product and it is operable; Fires precariously/haphazardly; no firing mechanism	The product is built and operating, but is inconsistent; none/insufficient firing mechanism	Solid build, functions as designed and has firing mechanism
COMPETITION	Does not bring the product, is incomplete or inoperable, is unable to compete	The product is incomplete or inoperable during competition	The product is available for competition but breaks/fails and is unable to participate in all activities	The product is available for competition but breaks/fails and is only able to participate in some activities	The product is present at competition, and is operational but precarious/finicky	The product is present at competition, is robust for use, and can be controlled by team
TEAMWORK	No group organization or distribution of tasks; splintering; independent work; Bickering	No group organization or distribution of tasks, but all work towards common goal; counterproductive	Somewhat organized, almost fair distribution of tasks/responsibilities and work somewhat cohesively	Some organization, fair distribution of tasks; cohesive effort; work somewhat cohesively	Works very well as a group; well distributed tasks and responsibilities; work somewhat well together	Works very well as a group; well distributed tasks and responsibilities; good report and symbiotic understanding/effort
PRESENTATION (TECH. CONTENT)	Poor statement and criteria. Missing analysis or the reasoning is flawed. Missing drawing, list of resources or the budget	Statement and criteria confusing or incomplete, missing only some of supporting materials	Statement and criteria confusing or incomplete, analysis poorly applied/accurate, incomplete drawings and/or budget	Statement and criteria good but analysis is partially developed, incomplete drawings and/or budget	Statement and criteria good, analysis well thought out and accurate, drawings available, partial budget/resources	Excellent statement and criteria, alternatives presented, analysis accurate, complete drawings, budget, resources
PRESENTATION (TEAM SKILL)	Poor organization, no transition in topics or speakers; inadequate visuals; significant errors; over/under time	Lacking some organization; inadequate transitions people and topics; poor visuals; many errors; over/under time	Some organization; inadequate transitions people and topics; poor visuals; many errors; over/under time	Some organization; good transitions' OK visuals' minimal errors' over/under time limit	Some organization; good transitions' OK visuals' minimal errors; appropriate time	Clear organization; excellent transitions; good visuals; no errors; appropriate time
PRESENTATION (INDIVIDUAL)	Significant grammatical errors, too low/loud; fast/slow; monotone, no eye contact, excessive ums, no questions answered	Simplistic use of language, some errors, volume too low or loud, too fast and/or slow, some eye contact, lots of ums, poor responses	Simplistic use of language, some errors, too fast and/or slow, OK eye contact, lots of ums, poor responses	Good use of language with few errors, volume not too soft or loud, speed OK, good eye contact, minimal ums, OK responses	Good use of language with few errors, volume OK, speed OK good eye contact, minimal ums, OK responses	Excellent use of language without grammatical errors, volume/tone emphasis, enthusiastic, eye contact, no ums, good responses to ?'s
FINAL REPORT	No Report	Report Submitted; poor quality; missing sections; no images; not professional	Report submitted but of poor quality; has all necessary components	Report Submission with all components; adequate effort/quality	Report organized and contains all necessary items; sufficient effort and if presentable.	Well organized and documents entire project timeline; good use of images and graphs; easy to read; professional and thorough

Using a combination of progress reports, deliverables review, self-reflection, and the final portfolio rubric, students were assigned a group score. Based upon the individual contribution, performance, and reflection, this score would be adjusted if it failed to meet any component of assessment.

Table 3-2. Project Grade Breakdown

Project Deliverables/Milestones (4 x 6.25%)	25%
Progress Reports	25%
Project Portfolio Review	50%

For ENR 240's final project, the Expected Level of Achievement was to have teams complete all components and each team member receive a final score of 70%.

The internally developed graduation exam was administered in ENR 240 of Spring 2024. The exam consisted of 9 questions and was designed to assess students' knowledge on various engineering related topics covered by the MET program. The engineering topics associated with each question are listed below given in Table 3-3. The Expected Level of Achievement was to have 70% of the cohort receive full or partial credit from each question in the test.

Table 3-3.

Topic	Question No.
Measurement/ Unit Conversion	Q1
Scientific Notation	Q2
Trigonometric Identity	Q3
Machining Process	Q4
Statics/ Strength of Materials	Q5
Materials of Engineering Technology	Q6
Strength of Materials	Q8
CAD	Q9
Unit Conversion/ Materials	Q10

County College of Morris

ACADEMIC OUTCOMES ASSESSMENT SUMMARY FORM Part 2

ACADEMIC YEAR: *2023 – 2024*
DEPARTMENT: *Engineering Technologies / Engineering Science*
PROGRAM: *P3700 Mechanical Engineering Technology including P5710 CAD Certificate, also Certificates of Achievement under MET*

PART TWO

What were this year's results? Present and reflect on the outcomes of implementing the assessment plan detailed in PART ONE above.

What are the results of your outcomes assessment process this year? Please include all data collected.

ELT 100 Assessment Results

The table below shows the result of the final exam for the ELT 100 course in the Spring 2024 semester. The students received nine problems. More than 50% of the students responded correctly to all problems except problems 5 and 9.

Table 4-1.

Final Exam Problem Number	Number of Students Out of 20 with Correct Response	Percentage of Students Out of 20 with Correct Response	Threshold of 50% of Students Giving Correct Response Met (Yes = 1, No = 0)
1	18	90%	1
2	17	85%	1
3	19	95%	1
4	10	50%	1
5	9	45%	0
6	17	85%	1
7	16	80%	1
8	14	70%	1
9	8	40%	0
Total			7

The final exam assessed PLO 1. The exam questions/problems are included in the Appendix. Each question/problem met the Outcome description.

The table below summarizes the student outcome collected from the example lab report where 50% or more of the students met the threshold score. The maximum score for each section of the report is given in column two. The third column of Table shows the threshold score for each section of the report. Out of 8 sections, 6 sections (75% of sections) met the 50% threshold.

Table 4-2.

Lab Report Section	Maximum Score	Threshold	Number of Students Out of 20 Meeting Threshold	Percentage of Students Out of 20 Meeting Threshold	Threshold of 50% Met (Yes = 1, No = 0)
Cover Page	10	7	20	100%	1
Abstract	5	3.5	12	60%	1
Table of Content	5	3.5	20	100%	1
Introduction	15	10.5	15	75%	1
Methods	15	10.5	17	85%	1
Results	20	14	18	90%	1
Discussion	15	10.5	15	75%	1
Appendices	15	10.5	10	50%	1
Total	100	70			8

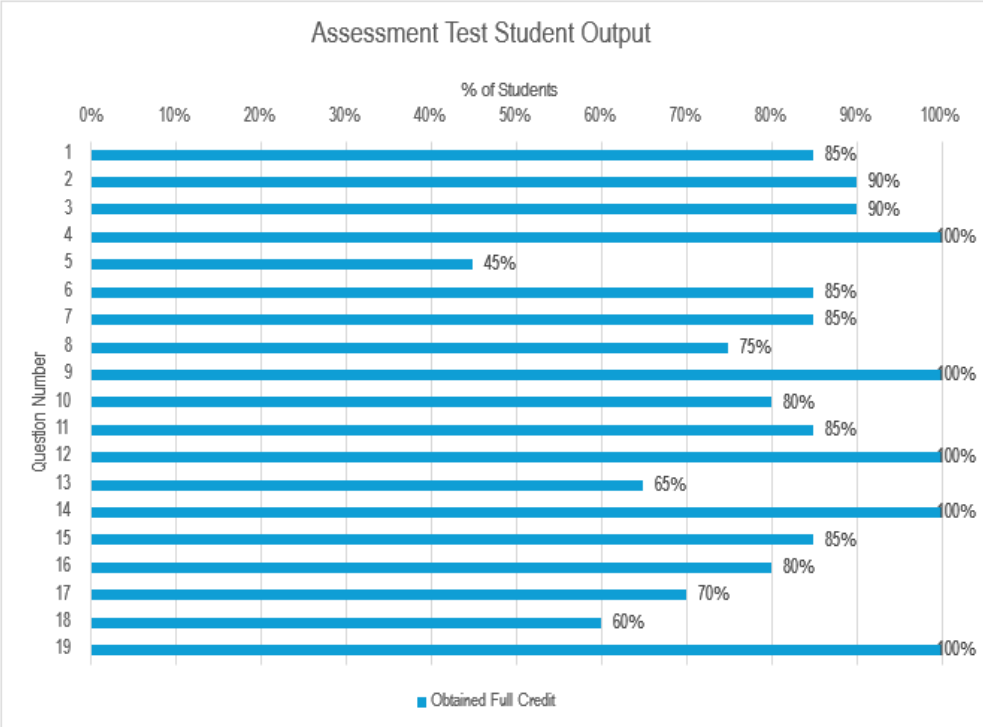
The lab activity was used to assess PLO 4. In this particular lab, students worked in a group of two to complete the following tasks:

1. Test the theoretical analysis of series-parallel networks through direct measurements.
2. Improve skills of identifying series or parallel elements.
3. Measure properly the voltages and currents of a series-parallel network.
4. Practice applying Kirchhoff's voltage and current laws, current divider rule, and the voltage divider rule.

PHY 112 Assessment Results

The results collected from PHY 112 Assessment Test administrated in Spring 2024 are summarized in Figure1. The test consisted of nineteen questions and twenty students took the test. The Expected Level of Achievement for the program was to have 70% of the students deliver a satisfactory output from this test.

Figure 1.



The results collected from the six lab reports are shown below. The Expected Level of Achievement for the program was to have 70% of the students deliver a satisfactory lab report.

Table 5

Lab Assignment	Maximum Score	Threshold	Number of Students Evaluated	Number of Students Meeting Threshold	Percentage of Students Meeting Threshold	ELA Satisfied
Oscillation & Wave	10	7	20	19	95%	√
Lenses	10	7	21	21	100%	√
Electric Charge	10	7	21	18	86%	√
Magnetic Field	10	7	21	20	95%	√
Lab 9	10	7	21	20	95%	√
Lab 10	10	7	21	20	95%	√

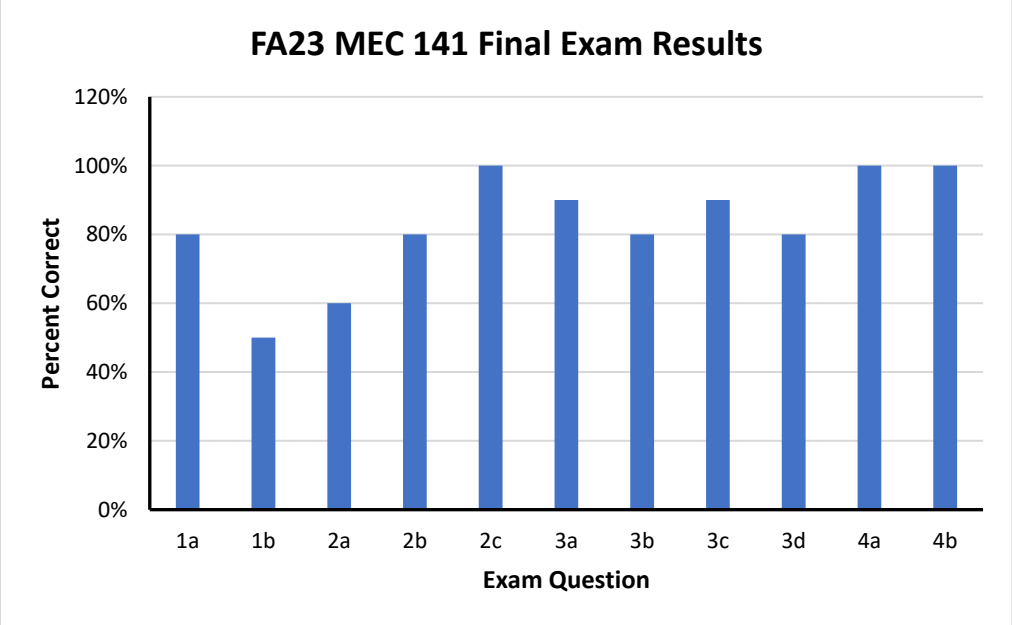
MEC 141 Assessment Results

The results of MEC 141 final exam administered in Fall 2023 are summarized in Table 6 and Figure 2.

Table 6.

Measures for Final Exam	Score
Number of students taking the final exam	20
Number of students passing the final exam	19
Percentage of students passing the final exam	95%
Median score	85%
Mean score	86%
Standard deviation	8
Number of problems	4

Figure 2 – Final exam results for MEC 141 of FA23



The results of the lab reports for the tensile test experiment are shown in Table 7 and Figure 3. In this experiment, students are required to use Pasco machines to apply tensile load on different metals, develop the stress-strain curves, calculate the elastic modulus of the metals, find the proportional limit from the stress-strain curves, and find percent elongation of the samples at the rupture point, and find the ultimate tensile stress for each metal.

Table 7.

Measures for Lab Report	Score
Number of students submitting the lab reports	20
Number of students passing the lab report activity	17
Percentage of students above 70% grade	85%
Median score	100%
Mean score	85%
Standard deviation	35
Number of sections in lab report	3

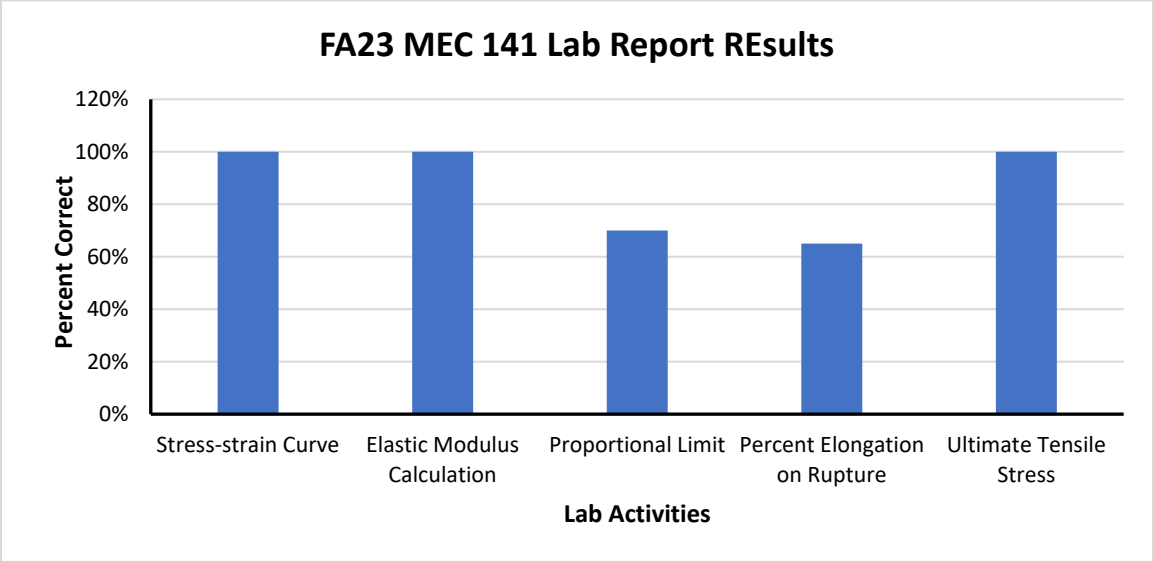


Figure 3 – Lab Report results for MEC 141 of FA23

ENR240 Assessment Results

Design Project

The following table shows the results for each team. Each team was comprised of 3 members.

Table 8.

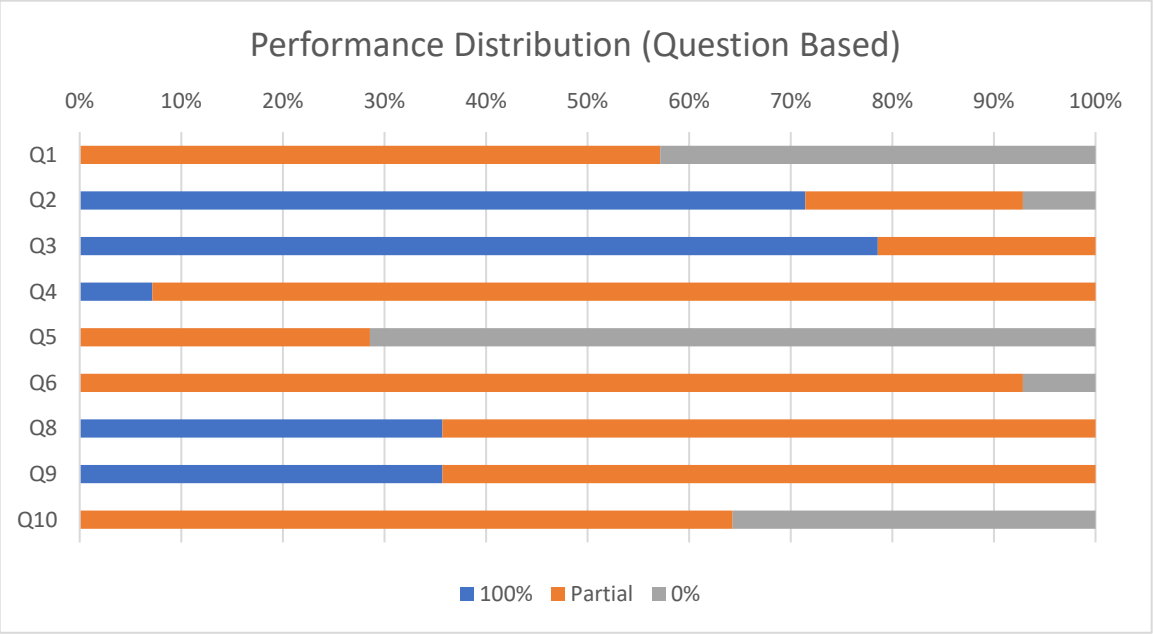
Evaluation Criteria	Points	Team 1	Team 2	Team 3	Team 4	Team 5	Avg	Avg (%)
Market Research	30	20	30	0	30	25	21	70%
Conceptualization	30	20	27	20	30	30	25.4	85%
Design for Manufacturing	30	15	15	15	28	26	19.8	66%
Production Planning & Prototyping	30	20	0	15	25	20	18	60%
Presentation and Report	10	8	9	8	9	8	8.4	84%
Total	130	93	81	58	122	109	92.6	
Average		72%	62%	45%	94%	84%	71%	

The evaluative project in MEC 240 is used to assess PLO 2 to 5.

Graduation Exam

The following chart shows the result of the graduation exam given in Spring 2024. There were 14 students taking the exam. Students' responses to each question were identified as 100% correct, partially correct, or 0% correct, and the chart illustrates the distribution of the result. The output is used to assess PLO 1.

Figure 4.



Evaluate and reflect on the results. Are they favorable? Disappointing? About what was expected? If the results did not meet the ELA, provide an action plan that includes revisions to and/or further development of your assessment plan.

Reflection on ELT 100

The ELA for the final exam was met. The expectation is that 70% of the students should pass the final exam. As shown in Table 4-1, 80% of the students passed. Problems 5 and 9 did not meet the 50% threshold.

The ELA for the lab activity was met. For the lab, 90% of students achieved a minimum score of 70%. To meet the ELA, 70% of the students should obtain a minimum score of 70%. Although the 50% threshold was met in all sections 20% (4 out of 20) of the students did not pass this assessment.

Several students did not provide adequate theory for the Introduction section of the lab report. Students were missing or not adequate providing the information required for the Method section of the report. Although students were provided with documentation concerning the

information required for each section of the report, some students failed to review the document. Early in the semester the instructor reviewed the report document with the students. Students must review the document again while compiling the report.

Reflection on PHY 112

The ELA for the assessment test was met. The result indicates that 80% of the students passed the assessment test, which is more than the 70% benchmark. As we analyzed the result more in depth by looking at each question individually, 70% or more of the students received full credit in all questions except Question 5, 13, and 18. In Question 5, students were asked to describe the process for measuring current; Question 13 was related to interpretation of scientific notation; Question 18 asked students to identify parallel circuits.

The ELA for lab reports was met. Students delivered satisfactory lab reports in all six lab exercises and more than 86% of the students received a score higher than the established benchmark, 7 out of 10, from each report.

The assessment result indicated this cohort retained a reasonable level of understanding of the material covered by the course. Students demonstrated the basic ability to apply knowledge, techniques, and skills of physics to solve well-defined engineering problems and the ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results as required in each lab exercise.

Reflection on MEC 141

The ELA was that 70% of the students should pass the final exam. 95% of the students passed the exam showing that the ELA was met for the final exam. Only 50% of the students gave the correct answer to problem 1b. This problem required students to make imaginary cuts and calculate shear force and bending moment at different sections of a beam. These results show that students lack confidence in calculation and the usage of formulas. In other words, most students turned out to be graphical learners rather than analytical learners.

Problems 2a and 2b got 60% and 80% correct answers, respectively. These problems required students to calculate moments of inertia with respect to x and y axes, respectively. This again indicates that students were not quite comfortable with the usage of formulas pertaining to moment of inertia.

The ELA for the lab report was also met as 85% of the students got greater than 70%. The lab report results showed that students were good in interpreting the test results and drawing diagrams of stress- strain for different metals. But they lacked paying attention to details and differentiating between elongation and strain. There is also a noticeable weakness in the usage of Greek letters to represent stress, strain, and shear stress.

Reflection on ENR 240

The final project occurs over the span of 6 weeks, culminating in the final competition, presentation, and report as a summative, multi-faceted assessment. It has proven to be a successful motivator for tactile students in the MET program, as well as allows for the opportunity to assess outcomes. By combining weekly formative assessments in the form of deliverables and progress check-ins with a summative report/presentation, students were able to navigate team development and collaboration, as well as manage multiple gates of a term project. Three out of five teams in this cohort met the minimum assessment benchmark of 70%. In closer analysis of the performance of Team 2 and Team 3, various factors had come into play such as the ability to keep up with the project timeline and the submission of incomplete deliverables.

The graduation exam was given to the cohort during one of the scheduled ENR 240 classes in Spring 2024. Fourteen students took the exam, and they were given the entire period to work on 9 questions. The result indicates that 70% of the cohort received full or partial credit for all nine questions except Question 1, 5, and 10. Both Question 1 and 10 were tied to the conversions of measurement unit; the tendency to omit details when interpreting measurement readings and the unfamiliarity with the conversion algorithm led to a low performance to Question 1 and 10. Question 5 required students to demonstrate their analytical ability on a force distribution problem using algebra. Lack of confidence and persistence appeared to be the main cause of low performance in this case.

How are results shared within department and/or with students?

During the semester other assessment tools are used for the same outcomes. Examples of the other assessment tools include quizzes, homework assignments, and midterm exam. These assessments were returned to the students to make them aware of their strengths and weaknesses. Students meet one-on-one with the instructor to turn the areas of weakness into strengths. Depending on the results of the assessments the instructor reviews with the students at the next meeting.

The final exams are not returned to the students. They are retained as part of the program assessment at the end of the semester. Students may request to see their final exams. The instructor will arrange with the students and review areas of weakness. Since all courses can be seen as prerequisites to other courses, even as the students transfer to 4-year institution, it is recommended that students know their strengths and weaknesses in all areas.

Assessment results are also shared with the members of our advisory board and faculty at the spring meeting.

County College of Morris

ACADEMIC OUTCOMES ASSESSMENT SUMMARY FORM Part 3

ACADEMIC YEAR: *2023 – 2024*
DEPARTMENT: *Engineering Technologies / Engineering Science*
PROGRAM: *P3700 Mechanical Engineering Technology including P5710 CAD Certificate, also Certificates of Achievement under MET*

PART THREE

How can we use the results? **Reflect on the changes in curriculum based on assessment, and on future goals.**

The unwillingness to use the checklist provided resulted in some students failing the lab reports activity assessment. The checklist includes the scores for each section and subsection of the report. By going through the checklist students can grade themselves. Those who followed the checklist got high scores. To help more students to do well, more emphasis will be placed on the checklist. More emphasis will be given to the sections of the report to ensure that students understand the requirements for each section.

Additionally, greater emphasis will be placed on report format and generation. Rubrics have been instituted that allow students to predicate the required elements that will be evaluated. Transparent evaluation rubrics have been shown to have a positive effect on outcomes.

No changes to the curriculum, based on this assessment, are recommended.