



Program Assessment Report (PAR)

Mechanical Engineering (ME) Masters Degree

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ACADEMIC YEAR COVERED BY THIS REPORT: 2021-2022

I. PROGRAM LEARNING OUTCOMES

Graduates of this program will be able to 1. Obtain employment suitable to their field or continue to further graduate study 2. Apply advanced engineering analysis techniques to the solution of complex problems 3. Articulate the results of complex engineering problems in written or oral form

II. PROCEDURES USED FOR ASSESSMENT

A. Direct Assessment

Closed loop process 1. Data collected by Masters program chairs during academic year 2. CQI committee analyzes and drafts suggestions 3. Charge grad committees with action 4. Grad committees report back with actions taken 5. Rinse and repeat Outcome 1. Percentage of students employed or going on to graduate study (from alumni and graduate exit surveys) Outcome 2. Class final exams collected, 3 data points total Outcome 3. Class final exams collected, 3 data points and/or thesis/papers/project reports

B. Scoring of Student Work

Courses chosen for data collection ME 7100 (Advanced Mechanics of Solids) ME 6330 (Compressible Flow) ME 7500 (Advanced Thermodynamics) Rubrics for Assessment of Student Work (Learning Outcomes 2-3) Outcome 2 Outstanding (95-100) Student demonstrates mastery of content and/or sophisticated analysis of problem nuances Strong (80-95) Student demonstrates competence at content and understanding of problem fundamentals. Small flaws in computation or logic may be present Acceptable (70-80) Student demonstrates basic understanding of content, but lacks depth. Significant errors or flaws in work present Developing

(60-70) Student lacks basic understanding. Struggles to start the problem or frame a valid analysis Needs Improvement (below 60) Student has essentially no understanding of how to solve or analyze the problem Outcome 3 Outstanding Mastery, sophisticated execution, nuances, no errors Strong Mastery, sophisticated execution at a level appropriate for the situation, with nuances, minor errors Acceptable Basic execution, lacks nuances, errors present Developing Basic execution, no nuances, major errors present Needs improvement Fails at basic execution or non-existent

C. Indirect Assessment

Outcome 1. Indirect assessment alumni and MS exit survey. Outcome 2. Indirect assessment MS exit survey. Outcome 3. Indirect assessment MS exit survey.

III. ASSESSMENT RESULTS/INFORMATION:

Assessment May 2021 Outcome 1. Graduates will obtain employment suitable to their field or continue to further graduate study Direct assessment - Qualtrics alumni survey, 2020, 16 responses to the question "True/False My MS degree helped me obtain a job/promotion or helped me pursue an advanced degree." 15/16 True. Indirect assessment - MSME exit survey, 2020-2021, Q33 "Please indicate your level of agreement with the following statement My MS degree helped me obtain a job/promotion in my field or helped me pursue an advanced degree." Only 3 responses NR, 4, 2. With NR data point removed, average response was 3.0/5.0. Outcome 2. The ability to apply advanced engineering analysis techniques to the solution of complex problems Direct assessment - Assessment 1 ME 7100 Exam #1, Fall 2020, Q1 Elasticity Solution for Axial and Bending, 15 students 3 outstanding, 7 strong, 1 acceptable, 4 needs improvement. 73% acceptable or above. Assessment 2 ME 7100 Exam #2, Fall 2020, Q1 Torsion of Noncircular Sections, 14 students 4 outstanding, 5 strong, 2 acceptable, 3 developing. 79% acceptable or above. Assessment 3 ME 7100 Exam #2, Fall 2020, Q2 Elasticity in Polar Coordinates – Point Load on Wedge, 14 students 2 outstanding, 3 strong, 2 acceptable, 2 developing, 5 needs improvement. 50% acceptable or above. Indirect assessment - MSME exit survey, 2020-2021, Q34, "Please indicate your level of agreement with the following statement My MS degree contributed to my ability to apply advanced engineering analysis techniques to the solution of complex problems." Only 3 responses NR, 5, 5. With NR data point removed, average response was 5.0/5.0. Outcome 3. The ability to articulate the results of complex engineering problems in written or oral form. Direct assessment - Assessment 1 ME 7500 Final Exam, Spring 2020, Q3 Essay Thermodynamic Properties of Solute and Solvents, 8 students, all achieving outstanding. 100% acceptable or above. Assessment 2 Unavailable in current cycle. Assessment 3 Unavailable in current cycle. Indirect assessment - MSME exit survey, 2020-2021, Q35, "Please indicate your level of agreement with the following statement My MS degree contributed to my ability to articulate the results of complex engineering problems in written or oral form." Only 3 responses NR, 4, 5. With NR data point removed, average response was 4.5/5.0.

Outcome 1. 15/16 responding alumni (or 94%) indicated the MSME program assisted with professional advancement. Only 3 MSME students completed the 2020-2021 exit survey; one agreed with the statement and the other did not. Outcome 2. Direct assessment from a core MSME grad class in 2020 indicated more than 70% of students were acceptable or above in 2 out of the 3 assessment measures. Only 50% were acceptable or above in the third assessment measure. Indirect assessment through the MSME exit survey had a low response rate, although the 2 respondents strongly agreed the outcome was satisfied. Outcome 3. Direct assessment from a core MSME grad class in 2020 indicated 100% of students were acceptable or above, although only 1 assessment measure was available in this cycle. Indirect assessment through the MSME exit survey had a low response rate, although the 2 respondents agreed or strongly agreed the outcome was satisfied.

Outcome 1. Direct assessment via the alumni survey indicated strongly that the outcome had been met. The MSME exit survey had only two responses, one positive and one negative, making it difficult to draw any additional conclusions. Outcome 2. Direct assessments from a core MSME grad class indicated the outcome was met in 2 out of 3 assessment measures. The third measure indicated need for improvement on a specific topic in the ME 7100 course. This result has been communicated to the instructor slated to teach the course in the Fall of 2021. Indirect assessment through the MSME exit survey had a low response rate, although both respondents strongly agreed the outcome had been met. Outcome 3. Direct assessment from a core MSME grad class strongly indicated the outcome had been met. However, the process also indicated a need for more assessment measures for this outcome, as only one measure was available in the current cycle. Indirect assessment through the MSME exit survey had a low response rate, although the 2 respondents indicated the outcome had been met.

IV. ACTIONS TO IMPROVE STUDENT LEARNING

Based on results of the prior assessment cycle, the CQI committee determined that direct assessment of Outcome 3 required the identification of required courses that include an oral presentation or written report. This result was shared with the Graduate Studies Committee, which subsequently conducted a survey of the MME faculty to identify all such courses. A subset of these courses will be used in the next assessment cycle to provide a more robust assessment of Outcome 3. These actions are documented in the minutes of the November, 2021 CQI meeting (attached). In 2021-2022, significant faculty discussion/action occurred regarding assessment of student learning in our graduate programs, with a focus on satisfaction of Outcome 3. In particular, there was some concern that non-thesis students may be able to navigate our graduate programs without taking a course having a significant writing/communication component. As a result, the writing/communication component survey data provided by the faculty graduate course coordinators was cross-checked against the transcripts of all students earning graduate degrees

in either the Spring 2021 or Fall 2022 semesters. The results of both the faculty survey and the cross-check are attached. Based on the above analysis, it was determined that all non-thesis students graduating in that timeframe took at least 2 courses having a significant writing/communication component. Coupled with the extensive writing/communication requirements of our M.S. thesis students, this suggests that our graduate programs are appropriately structured to address Outcome 3. As documented in the minutes of its latest meeting (attached), the CQI committee is prepared to suggest a new MS degree program requirement to ensure the satisfaction of Outcome 3 by all students. However, based on our current slate of graduate course offerings and the analysis presented above, such a change may not be necessary at this time.

V. SUPPORTING DOCUMENTS

Additional documentation, when provided, is stored in the internal Academic Program Assessment of Student Learning SharePoint site.