Based on the Committee’s review of the assessment evidence for all detailed outcomes in our Area of Expertise, including but not limited to the relevant course design and assessment forms for the courses in this area, we provide the following responses representing our level of agreement with two main issues relative to the outcomes: 1) The assessment evidence used for each specific outcome appears to be a valid and reliable indicator of whether or not the students achieved the outcome at the required level, and 2) The assessment evidence presented for each specific outcome shows that all students who passed the course during this academic year actually did achieve the outcome at the required mastery level.

Circle the response representing the committee’s level of agreement with each statement for each outcome (SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree).

<table>
<thead>
<tr>
<th>DETAILED LEARNING OUTCOMES IN THIS AREA OF EXPERTISE</th>
<th>Assessment evidence is valid and reliable</th>
<th>Evidence shows all students achieved outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3.1) An ability to perform statistical data analysis of univariate and bivariate data</td>
<td>SA A D SD</td>
<td>SA A D SD</td>
</tr>
</tbody>
</table>

**Justification for the responses:**
Provide some discussion or justification for all responses. Additionally, any responses of D or SD for any outcomes must be accompanied with a detailed discussion of the reason for the low rating and a plan of action for rectifying the problem.

**Recommended Action Items for Continuous Improvement:**
Based on the committee’s review of the current program outcomes statements, the curriculum and learning activities currently used to help students achieve the outcomes, and the assessment evidence used to assess achievement of the outcomes, we make the following recommendations for continuous improvements of the program (to improve student performance) and/or the assessment process (to better assess student performance).

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Recommended Actions for Continuous Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program outcomes statements</td>
<td></td>
</tr>
<tr>
<td>Curriculum and learning activities</td>
<td></td>
</tr>
<tr>
<td>Evidence used for assessment</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Signature of committee chairman  
Date

Committee Name-Year-1
Section 1: Course design (Identify learning activities, assessment evidence, and certification procedures to ensure student achievement of outcomes)
   o You may address all outcomes individually or address multiple outcomes in combination, whichever is more efficient
   o Please identify all items which have been changed for continuous improvement since the last time this course was taught. Use a bold (CI) designation.

Part 1) Complete for all Specific Program Outcomes Assessed in This Course (i.e. all tollgate outcomes)

Mastery Level Outcomes

1-3.1) An ability to perform statistical data analysis of univariate and bivariate data sets

I will hand out resource material to be reviewed and used by students. There will be a lecture/discussion on basic statistics and applications in data analysis/uncertainty analysis. Students will complete Lab exercise 2: Statistical Data analysis of Univariate Data Sets and Lab exercise 4: Graphical Data Analysis and Curve fitting of bivariate data, and after receiving feedback on their work they will be required to correct any significant errors and resubmit their work. There will also be Quiz questions directly related to statistical data analysis, and the students will get detailed feedback on their performance. [CI: improved and updated based on student feedback from Spring 2002. See copies of exercises in course binder for details]

1-3.1) Assessment Evidence (Performance Criteria)

The final lab project will have a requirement for statistical data analysis of both univariate and bivariate data sets. See the assignment and the “project rubric for assessment and grading” (pages A1-A2, & A21) and the copies of graded and assessed student work (pages A2-A71, but primarily A2 & A27) for details.

1-3.1) Certification Procedure (Procedure to ensure all students who pass this course have met the outcome at the required level)

See “Common certification procedure for most ME398 tollgate outcomes” on page 3 of this document.

Common Certification Procedure for most ME398 mastery-level outcomes (used unless otherwise noted)

Mastery-level outcomes: Mastery learning via recycling until both ability and understanding are clearly demonstrated
   o The work in the final project that is directly related to the tollgate outcomes must be completed correctly and explained sufficiently, or must be redone until both ability and understanding are clearly demonstrated.
   o To assess individual student achievement of the outcomes in the group project, there is a requirement for each student to submit an individual conclusion, summary, and evaluation. Additionally, the instructor will have a short meeting with each student during the final exam period and will ask a few short questions to judge the student’s involvement in the group project and their mastery relative to the tollgate outcomes.
Part 2) Complete for all other course outcomes, including non-tollgate specific program outcomes and outcomes that support the specific program outcomes. (Note that formal assessment is not required for these outcomes - they are identified for purposes of efficient course design and to support continuous improvement efforts for all program outcomes.)

Other Student Learning Outcomes for this Course
[Identify all additional outcomes here by number and description (required for all courses); include course info related to outcomes as desired]

<table>
<thead>
<tr>
<th>Outcome Description</th>
<th>Survey questions related to Learning Outcomes (LO) Assessed in This Course</th>
<th>Survey question responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5.5) The ability to use general engineering analytical software (for example MATLAB) as a tool for solution of common engineering problems (using capabilities such as numerical methods, vector analysis, and matrix operations)</td>
<td>1-3.1) An ability to perform statistical data analysis of univariate and bivariate data sets</td>
<td>SA A D SD Comments/suggestions for improvement:</td>
</tr>
<tr>
<td>MATLAB and EXCEL are used extensively for data analysis and plotting/presenting data in various forms. Some instruction is given in the use of MATLAB for statistical analysis, but the students primarily learn by doing and asking questions as necessary.</td>
<td>1-3.1_S1) This learning outcome and its required mastery level were clearly communicated to me early in this course.</td>
<td>SA A D SD</td>
</tr>
<tr>
<td>4-1.1) An understanding of the need to consider safety and an awareness of methods for increasing safety in all aspects of the engineering profession, including safety in testing, safety during manufacturing, and product safety</td>
<td>1-3.1_S2) The learning activities associated with this outcome (as defined in the course design template) helped me achieve this outcome at the required mastery level.</td>
<td>SA A D SD Comments/suggestions for improving learning activities:</td>
</tr>
<tr>
<td>Safety in the lab is emphasized and enforced at all times, and safety is included as one of the important considerations in experimental design.</td>
<td>1-3.1_S3) The assessment activities and the mastery learning procedures used for this outcome (as defined in the course design template) were an appropriate means for measuring and ensuring my achievement of this outcome at the required mastery level.</td>
<td>SA A D SD Comments/suggestions for improving assessment activities:</td>
</tr>
<tr>
<td></td>
<td>1-3.1_S4) I believe that I achieved this learning outcome at the required mastery level.</td>
<td>SA A D SD , Comments/suggestions for improvement:</td>
</tr>
</tbody>
</table>

Section II: Student survey to evaluate outcomes and processes
A survey was administered near the end of the quarter in an online format on the Blackboard course web site. The instructions and the general form of the questions are copied below. The specific survey questions and results are presented on pages -.

Instructions: Please complete this survey dealing with the program outcomes assessed in this course, in each case selecting the appropriate response. Note the following interpretations of the 4-point rating scale. [SA=Strongly Agree (excellent, no changes required), A=Agree (Good, some improvement possible), D=Disagree (Fair, some improvement needed), SD=Strongly Disagree (Poor, significant improvement required)]. Your input is most valuable if you seriously consider each rating based on your experience this quarter, and especially if you add comments and/or suggestions for improving the course and/or the ME curriculum to help you better achieve each outcome.

General form of the questions for each outcome:
I certify that all students who passed this course achieved the mastery-level learning outcomes.  

Instructor Signature

Please complete the form below for all outcomes, in each case selecting the rating (Inadequate: unacceptable, improvements are required; Adequate: acceptable, but improvements are desirable; Exceptional: no improvement needed) that corresponds to your opinion of the learning activities or the assessment evidence used this quarter. Additionally, based on your experience this quarter and your review of the student survey results justify your evaluation and identify your ideas/plans for changing the course and/or the ME curriculum in an attempt at improving student achievement of each outcome. Note that all plans for continuous improvement (CI) should be discussed in the quarterly “Area of Expertise” review meetings, and all plans that are accepted for implementation must be reflected in the course design template the next time the course is taught.

<table>
<thead>
<tr>
<th>Learning Outcomes (LO) Assessed in This Course</th>
<th>Evaluate assessment evidence and mastery learning procedures and identify plans for CI</th>
<th>Evaluate learning activities and identify plans for CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastery Level Outcomes</td>
<td>Evaluation evidence and mastery learning procedures</td>
<td>Evaluation evidence and mastery learning procedures</td>
</tr>
<tr>
<td>1-3.1) An ability to perform statistical data analysis of univariate and bivariate data</td>
<td>Inadequate Adequate Exception</td>
<td>Inadequate Adequate Exception</td>
</tr>
<tr>
<td>Justification and plans for CI: The assessment tool is effective as is</td>
<td>Make minor improvements/clarifications to Lab 2 based on student feedback.</td>
<td></td>
</tr>
</tbody>
</table>

Are any changes required to the learning outcomes required for this course (wording of outcomes statement, required mastery level, move to different course…)?

Yes

If yes, list the recommend changes. In 1-3.1 consider deleting the words “and bivariate data sets” since that is better addressed in 1-3.2 curve fitting. And 3-1.1.f consider adding the words “or on lab data sheets” to agree with common data collection procedures.

Summarize the action items resulting from this assessment (for discussion at the Area of Expertise Committee review): Update some of the learning activities and assessment activities as noted above and as shown on the attached report (page 9), mainly for improved clarity. Arrange class to get to the project ASAP – actually introducing it in the first week and interspersing the lab exercises for learning with the lab project for application/assessment. Give frequent and timely feedback on the project and make sure there is time for students to seriously deal with the “real world” experimental issues.
Ohio University, Mechanical Engineering Department, Course design template and assessment form

Learning Outcomes Assessment Checklist (required for all tollgate courses)

<table>
<thead>
<tr>
<th>Course #: ME398</th>
<th>Course Title: Junior Lab</th>
<th>Instructor: Dr. Greg Kremer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Completed</strong></td>
<td><strong>Checklist of items that must be completed and documented for each outcome each time the course is taught</strong></td>
<td><strong>Page #</strong></td>
</tr>
<tr>
<td>9/6/02</td>
<td>Review the assessment evidence (including the student surveys and the instructor reflection report) from the last time this course was taught, review all action items for continuous improvement in the most recent yearly faculty program review report, and implement all action items related to this course. Based on these reviews and on recommended pedagogical practice, complete Section I of the course design template and assessment form and prepare the student survey instrument as described in Section II (prior to the first class meeting).</td>
<td>1-5</td>
</tr>
<tr>
<td>9/9/02</td>
<td>Clearly communicate to the students the intended learning outcome(s) for this course, the course design to achieve the outcomes (including the mastery learning* procedures that will be used to ensure that all students who pass the course have met the tollgate outcomes at the required level), and their important role in the outcomes evaluation process. Provide the students with copies of sections I and II of the course design template and assessment form (in the first week of the quarter).</td>
<td>NA</td>
</tr>
<tr>
<td>Throughout course</td>
<td>For all tollgate outcomes, clearly communicate to the students in written form the basis for the grading of the assessment activities and how the grades reflect achievement of the learning outcome. Save copies of the documents (for example the grading rubrics) that clearly indicate how the grading information was communicated to the students and how the grading procedure was implemented.</td>
<td>Included with assessment activity copies</td>
</tr>
<tr>
<td>11/18/02</td>
<td>For all tollgate outcomes, save representative examples of the assessment evidence (i.e. the student work on the assessment activities) in an attempt to demonstrate what you consider acceptable evidence of student achievement of the outcome at the required level and to demonstrate the application of the grading policy and the mastery learning procedure.</td>
<td>A1-A89</td>
</tr>
<tr>
<td>11/18/02</td>
<td>Conduct the student survey to evaluate outcomes and processes (using the standard survey form) and save copies of the results. Results overall are good, with main suggestions for improvement focused on statistics (need required Statistics course as a prereq), changing Lab 1 so all students get experience using multiple pieces of equipment (see S10), and the usual requests for more lecture and examples (some students still prefer passive learning even though it is overall less effective).</td>
<td>5, S1-S12</td>
</tr>
<tr>
<td>11/25/02</td>
<td>Complete an instructor reflection report (using the standard template) with a focus on closing the loop for continuous improvement of the program and the process, and save a copy of the completed form.</td>
<td>6-7,9</td>
</tr>
</tbody>
</table>

* The methods used to provide formative feedback and to require recycling (reviewing and redoing work until the required performance level is clearly demonstrated)
### ME398 Motor Specifications Project: Rubric for Assessment & Grading

#### Steps 1&2: Designing and planning the experiment (~10% of grade, used for assessment of outcome 1-3.4: designing and planning experiments)

The experiments were planned well as evidenced by:
- A proper and complete pre-test experimental procedure outline is included and referenced
- A discussion of experimental design/planning issues in the Introduction section
- There is clear documentation that “desired attributes of the data set” and “desired level of accuracy” were considered for each individual measurement/experiment
- The required # of measurements to achieve desired level of accuracy was computed/used
- The experimental procedure is explained in sufficient detail that the experiment could be reproduced by any competent researcher under the same experimental conditions
- Clear sketches showing the experimental setup and equipment identification are included

#### Step 3: Conducting and documenting the experiment (~10%)

The experiments were conducted and documented well:
- Lab notebooks / data sheets were used to properly record data (used for assessment of outcome 3-1.1.f: proper use of lab notebooks for documenting experimental work)
- Calibration and acceptability of measurement system (i.e. is it capable of achieving the desired level of accuracy in single or multiple measurements) were evaluated before/during the experiment
- Repeatability tests and/or prediction/verification tests were run for verification of key results (i.e. torque-speed curve was used to get a predicted range for a certain case then measurements were made for that case to see if the actual result was in the predicted range)

#### Step 4: Analysis/Discussion of results (~45% of grade, used for assessment of outcome 1-3.1: statistical data analysis and 1-3.2 curve fitting)

The data analysis was conducted correctly and completely following the guidelines in Step 4 of the Experimental Design Roadmap using proper tools and techniques used in this class:
- Plots and charts and tables and other proper data presentation techniques we used appropriately and were executed well
- Data sets were evaluated appropriately to make sure data analysis techniques were valid for the data set (i.e. is data normally distributed, was Chauvenet’s criterion applied if necessary, is variation dominated by measurement or measurand uncertainty and what implications does that have for the data analysis,…)
- Statistical data analysis was used properly for univariate data sets and standard curve-fitting methods were used properly for bivariate data sets.
- Uncertainty levels were computed correctly (and documented clearly with sample calcs) and were critically evaluated versus desired level of accuracy
- Results and uncertainties were reported both for an individual motor and as predictions for the entire series of motors (\(\sigma\) and \(\sigma_{\text{mean}}\) were used appropriately in each case).
- Physical realism of all results and uncertainties were evaluated and “idiot checks” were used to make sure no clearly incorrect results were reported.

#### Step 5: Overall quality of group formal lab report (~15%)

- All key sections are included and each section addresses the proper information as defined in the Experimental Design Flowchart.
  - Focus of the abstract is appropriate.
  - Intro includes info on motor specifications, DC motor expected characteristics, etc.
- Report is well-written (concise, clear, organized), well-edited (free of grammatical/spelling errors, clear indication that an internal review process was used), and all sections are integrated well into the overall report
- Effective methods for presenting information are used, including visual methods.
Faculty Review of High-Level Outcomes Assessment and Evaluation of Objectives

**Academic year:**

**Date of review meeting**

### High-level outcomes assessment

Based on the ME faculty review of the assessment evidence, including the Area of Expertise Committee reports on assessment of all of the detailed outcomes, we provide the following responses representing our level of agreement with the program outcome statements.

Circle the appropriate response (SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree).

<table>
<thead>
<tr>
<th>1-1. (ABET-c)</th>
<th>OU ME graduates will demonstrate an ability to design a system, component, or process to meet desired needs</th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2. (ABET-e)</td>
<td>OU ME graduates will demonstrate an ability to identify, formulate, and solve engineering problems</td>
<td>SA</td>
<td>A</td>
<td>D</td>
<td>SD</td>
</tr>
</tbody>
</table>

... Justification for the responses:

*Provide some discussion or justification for all responses, including identification of all evidence reviewed (transcripts, co-curricular resumes, summary reports, advisory board reports, …). Additionally, any responses of D or SD for any outcomes must be accompanied with a detailed discussion of the reason for the low rating and a plan of action for rectifying the problem.*

### Evaluation of Objectives

Based on the ME faculty review of the evidence for evaluating the program’s achievement of its objectives, we provide the following responses representing our level of agreement with the program objective statements.

Circle the appropriate response (SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree).

| 1 | OU ME graduates are prepared to practice as entry-level mechanical engineers (Engineers in Training) in a range of specialty areas, including design of thermal/fluid systems, design of mechanical systems, manufacturing, materials, or other related areas; or (for those graduates with the ability and the desire) to gain entry to and successfully complete an advanced degree program in engineering, business, medicine, or any other related field | SA | A | D | SD |

... Justification for the responses:

*Provide some discussion or justification for all responses, including identification of all evidence reviewed (alumni surveys, advisory board reports, …). Additionally, any responses of D or SD for any objectives must be accompanied with a detailed discussion of the reason for the low rating and a plan of action for rectifying the problem.*

### Action Items for Continuous Improvement:

*All action items from the Committee reports for the assessment of the detailed outcomes and the advisory board program review and the alumni survey summary should be reviewed and those that are endorsed by the overall faculty should be presented here.*

__________

*Signature of faculty Assessment & CI coordinator* 

__________ 

*Date*