

## I. Writing Plan Cover Page

*Please fill in the gray areas on this form.*

**February 18, 2016**

Subsequent Edition of Writing Plan: previous plan submitted Fall/2009, First edition submitted Fall/2007

Mechanical Engineering

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WEC Unit Name

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Mechanical Engineering

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College of Science and Engineering

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Department

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College

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William Durfee

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Professor

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WEC Faculty Liaison (print name)

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Title

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[wkdurfee@umn.edu](mailto:wkdurfee@umn.edu)

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612-625-0099

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Email

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Phone

### Writing Plan ratified by Faculty

*Note: This section needs to be completed regardless of Writing Plan edition.*

Date: October 13, 2013

If Vote:            /             
                  # yes                   # total

Process by which Writing Plan was ratified within unit (vote, consensus, other- please explain):

Consensus

**II. Unit Profile: Unit Name**

*Please fill in the gray areas on this form.*

**Number of Tenured and Tenure-Track Faculty:**

<u>26</u>	Professors
<u>6</u>	Associate Professors
<u>9</u>	Assistant Professors
<b><u>41</u></b>	<b>Total</b>

**One Teaching Professor contributes to instruction**

**Major(s)**

*Please list each major your Unit offers:*

**Total # students enrolled in major as of AY 14**

**Total # students graduating with major AY 14**

Bachelor's of Mechanical Engineering

782

232

**Total:**

782

232

**WEC Implementation Process**

**Semester/Year-Semester/Year**

**# participated / # invited**

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### III. Signature Page

*Signatures needed regardless of Writing Plan edition. Please fill in the gray areas on this form.*

If this page is submitted as a hard copy, and electronic signatures were obtained, please include a print out of the electronic signature chain here.

#### WEC Faculty Liaison

William Durfee

Professor

WEC Faculty Liaison (print name)

Title

  
Signature

February 18, 2016  
Date

#### Department Head/Chair

Uwe Kortshagen

Professor and Department Head

Print Name

Title

  
Signature

April 1, 2016  
Date

#### Associate Dean

Paul Strykowski

Associate Dean for Undergraduate Programs

Print Name

Title

  
Signature

April 6, 2016  
Date

#### For College of Liberal Arts units only:

CLA - Curriculum, Instruction, and Advising Committee approved Writing Plan  
on

Date

Print Name

Title

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Signature

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Date

## IV. Writing Plan Narrative, 3<sup>rd</sup> Edition

*Please retain section headers and prompts in your plan.*

### **Introductory Summary:**

*Briefly describe the reason(s) this unit (department, school, college) become involved in the WEC project, the key findings that resulted from the process of developing this plan, and the implementation activities that are proposed in this Writing Plan, with particular attention to the following questions: what is new in this 3<sup>rd</sup> edition of the Writing Plan? What, if any, key changes have been made to the 2<sup>nd</sup> edition? What key implementation activities are proposed in this edition of the Writing Plan? (1 page maximum)*

The ability to communicate is essential in mechanical engineering. It is not sufficient to have an idea; that idea must be communicated clearly and concisely to other members of a design team, to managers, to academic researchers, to a newspaper reporter, to the general public, or to oneself through a design notebook.

At the University of Minnesota, the Mechanical Engineering faculty recognize that students do not enter our undergraduate program as competent technical writers and that many are not proficient in the standards of academic writing. Therefore, we recognize that it is our responsibility to provide our undergraduate majors with an education in technical communication. We expect that every undergraduate receiving a degree in mechanical engineering is competent in written technical communication. Because learning is the shared responsibility of faculty and students, it is the responsibility of students to know that the department has high expectations for their engineering writing, that they should strive to become better engineering writers while they are in our program and that they will experience some form of engineering writing instruction in all core mechanical engineering courses.

The changes in the 3<sup>rd</sup> edition plan are:

1. Introduction revised to clearly state that it is the responsibility of the department to provide writing instruction.
2. Writing Characteristics: Numbered the characteristics. Characteristics 7-9 cleaned up to clarify intent. Added characteristic 10: correct mechanics because of the desire to make this explicit.
3. Writing Abilities: Combined redundant abilities. Revised several abilities to clarify intent. Deleted "write in the style of academic journal article" ability because it is not taught to all students and an ability that is not taught by us cannot be expected to be acquired by students. (Honors students will gain this ability because often their thesis is in the form of a journal article.) The result is that the number of abilities was reduced from 14 to 12 (in the spirit of engineering conciseness.)
4. Integrating Writing into the Curriculum: Rearranged and reworded content to clarify. Revised table that maps writing ability to characteristics, products and assessments. Updated section on ABET
5. Assessment: Some revisions to regular assessment process. Closer tie to biennial course review that is conducted as part of the ABET process. Added rating criteria.
6. Support to Maintain: Listed all stakeholders who are needed to maintain the program, and their core responsibilities.
7. Learning Outcomes: No changes.

### **Section 1: DISCIPLINE-SPECIFIC WRITING CHARACTERISTICS**

*What characterizes academic and professional communication in this discipline?*

- There have not been substantial revisions to this section of the Writing Plan.*
- There have been substantial revisions to this section of the Writing Plan. (See above)*

Effective writing in mechanical engineering is:

1. Pointed, concise and factual, avoiding redundancy, abstraction, and extraneous information
2. Data-driven for accuracy and credibility
3. Systematic, logical and efficient in describing and solving problems
4. Seamless in its integration of textual, numeric, and graphic information
5. Explanatory, often involving depiction of spatial objects and description of complex technical concepts and data
6. Predictable in its use of prescribed format and structure
7. Collaboratively authored when work is conducted by a distributed team
8. Presented in multiple formats, including documents, presentations, posters and web sites
9. Written and formatted in ways that are appropriate for technical or non-technical audiences depending on the purpose of the writing
10. Expressed using correct mechanics

### **Section 2: DESIRED WRITING ABILITIES**

*With which writing abilities should students in this unit's major(s) graduate?*

- There have not been substantial revisions to this section of the Writing Plan.*
- There have been substantial revisions to this section of the Writing Plan. (See above)*

At graduation, undergraduate students in mechanical engineering should be able to:

1. Apply knowledge of physics, mathematics, and engineering in their writing
2. Record and analyze activity related to laboratories and design projects
3. Visually represent technical concepts and designs to explain their salient features
4. Synthesize and summarize key points
5. State and explain engineering project metrics such as productivity, costs and time to completion
6. Analyze the audience and create a document that meets their needs
7. Represent themselves professionally through their writing
8. Explain, discuss, and demonstrate physical apparatus
9. Integrate visual, textual and oral explanations
10. Create team-written documents using collaborative authorship tools
11. Produce documents in the styles used by professional engineers
12. Write according to style guidelines approved by mechanical engineering faculty

## Menu of Rating Criteria

For use by faculty in rubrics as appropriate to the assignment, and by raters in WEC rating sessions:

Writing Ability	Rating/Grading Criteria
1. Apply knowledge of physics, mathematics, and engineering in their writing	-Applies knowledge of physics, mathematics, and engineering in writing
2. Record and analyze activity related to laboratories and design projects	-Communicates methods and results from an experiment or computer simulation  -Interprets and acts on result related to laboratories or design projects
3. Visually represent technical concepts and designs to explain their salient features	-Visually represents technical concepts to explain their salient features  -Visually represents technical designs to explain their salient features  -Uses figures and graphs to explain concepts
4. Synthesize and summarize key points	-Summarizes key points  -Synthesizes key points
5. State and explain engineering project metrics such as productivity, costs and time to completion	-Demonstrates engineering project metrics such as productivity, costs and time to completion
6. Analyze the audience and create a document that meets their needs	-Is written in ways that consistently addresses target audience
7. Represent themselves professionally through their writing	-Writing represents author professionally
8. Explain, discuss, and demonstrate physical apparatus	- Explains complex concepts, results and physical apparatuses.
9. Integrate visual, textual and oral explanations	-Integrates visual and textual explanations
10. Create team-written documents using collaborative authorship tools	-Is a team-written document where all authors have contributed
11. Produce documents in the styles used by professional engineers	- Is written in the style used by professional engineers  - Is written in the style of professional engineering reports and articulates the target problem  -Is written in the style of professional engineering reports and solves a problem
12. Write according to style guidelines approved by mechanical engineering faculty	-Is written according to style guidelines in the Mechanical Engineering style guides  -Is grammatically and mechanically correct

	-Cites sources appropriately -Is concise
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**Section 3: INTEGRATION OF WRITING INTO UNIT’S UNDERGRADUATE CURRICULUM**

*How is writing instruction currently positioned in this unit’s undergraduate curriculum (or curricula)? What, if any, course sequencing issues impede an intentional integration of relevant, developmentally appropriate writing instruction?*

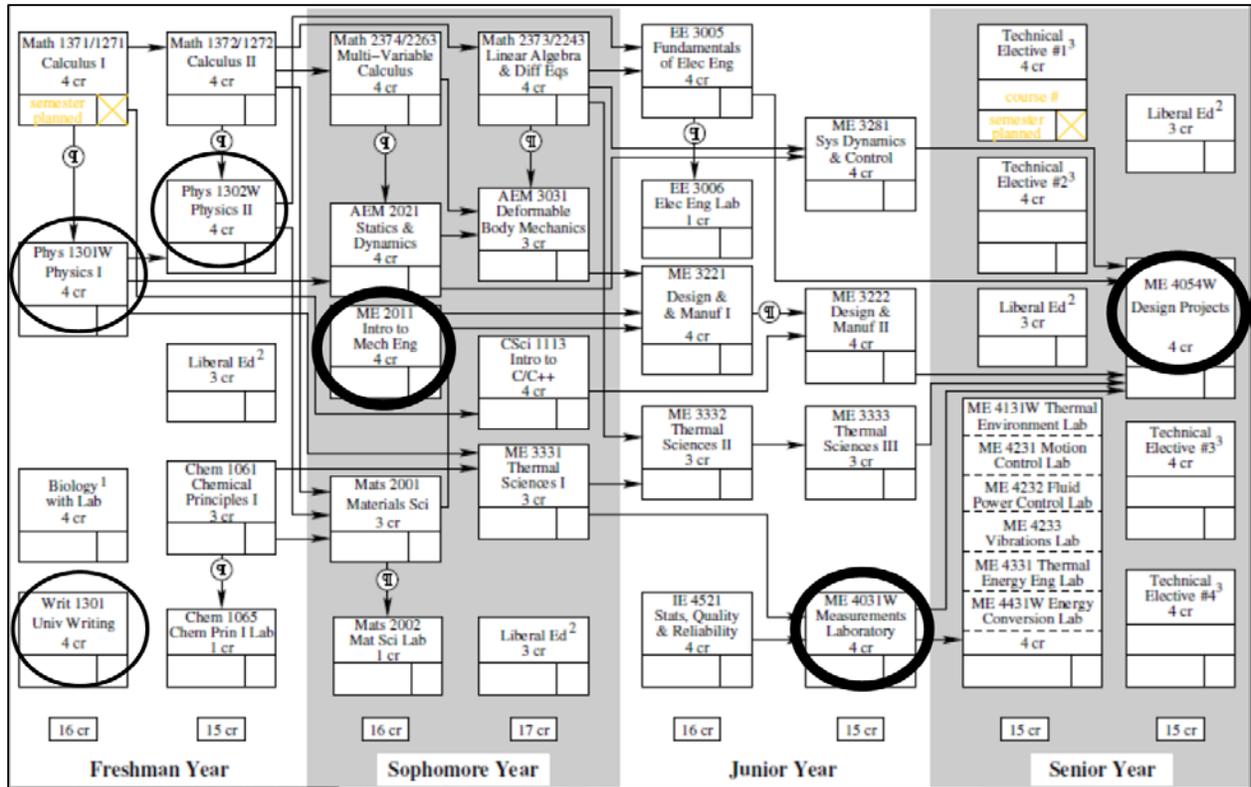
- X There have not been substantial revisions to this section of the Writing Plan.*
- There have been substantial revisions to this section of the Writing Plan. (Discuss these explicitly.)*

Implementation of the Mechanical Engineering Writing Program starts with the following four assumptions:

1. Students do not enter the undergraduate program as competent technical writers.
2. It is the responsibility of our department to participate in writing instruction for our students.
3. Mechanical Engineering faculty generally will not spend extra time teaching or evaluating writing mechanics.
4. Problem sets, lab reports and design reports are the three most common forms of writing done by undergraduate students in mechanical engineering.

**Overview of the Curriculum**

Figure 1 displays the mechanical engineering undergraduate curriculum with the circles around the courses where significant writing instruction occurs. Because of the structured curriculum with strict pre-requisites in the core courses, the combination of the circled courses and the emphasis on communication in the engineering science problem set courses means that writing touches students every semester of the suggested curriculum.



**Figure 1.** The Mechanical Engineering undergraduate curriculum. Courses targeted for writing instruction are circled. Courses offered within the department have thick circles. Service courses offered by other departments have thin circles.

Early writing instruction is covered in the service courses WRIT 1301/1401, one of which is required of all University of Minnesota students, with some students required to take WRIT 1201 in addition. Additional early instruction occurs in service courses Phys 1301W and Phys 1302W that primarily cover the writing of lab reports. The core courses offered by the department that have explicit writing instruction are ME 2011 Introduction to Engineering, ME4031W Measurements Lab and ME4054W Design Projects.

The remainder of the department core curriculum courses are engineering science courses that rely significantly on problem sets, for example, ME 3331/2/3, the three-course thermal science sequence, ME 3221/2, the two-course design and manufacturing sequence, ME 3281 System Dynamics and Control and IE 4521 Statistics, Quality and Reliability. Students also take one senior lab course from a selection of six offered within the department and four technical electives, some of which can be outside the department.

Within the core engineering science courses, the department expects certain standards for communicating technical content through the weekly problem sets delivered by students. Within the senior lab courses, the department expects certain standards in the writing of laboratory reports that builds on the lab report writing instruction and expectations introduced in ME 4031W, the pre-requisite course, and earlier in ME2011, the introductory course.

The following table illustrates the types of writing done in each course.

<b>Course</b>	<b>Types of Writing</b>
WRIT 1301/1401	academic writing, including reports with citations
PHYS 1301W/1302W	lab notebook, lab reports, problem sets
ME 2011	sketching, CAD, oral presentation, design notebook, short technical reports, lab reports, design report, resume, portfolio
ME 3281	problem sets
ME 3331/2/3	problem sets
ME 3221/2	problem sets, group authored design report
ME 4521	problem sets
ME 4031W	lab notebook, lab reports
ME 4xxx	(Senior Labs) lab notebook, lab reports
ME 4054W	design notebook, project web site, project proposal, project plan, oral presentation, poster, group-authored design report

The three core courses offered within the department that have significant writing instruction are listed in the following table.

<b>Course</b>	<b>Writing Instruction</b>
ME 2011	Instruction on maintaining a design notebook, writing a lab report, delivering a technical presentation, writing a resume, informal professional writing and other technical writing forms. Evaluation and critical review of student writing. Introduction to department writing standards and style guides.
ME 4031W	Instruction on maintaining lab notebooks and writing lab reports. Formal and informal evaluation of writing.
ME 4054W	Instruction on maintaining a design notebook, writing technical documents, writing a group-authored design report, team communication, communicating with project sponsors. Formal and informal evaluation of writing including review of drafts.

The first pillar of the writing program is that students experience discipline specific writing and receive discipline specific writing instruction in three core courses: ME 2011, ME 4031W and ME 4054W. In ME 2011 students learn a range of writing genres, including some that are covered in more detail in later courses. ME 4031W focuses on lab notebooks and lab reports while ME 4054W is concerned with writing related to design projects including notebooks, proposals, project plan and design reports.

The second pillar of the writing program takes place in the core and elective engineering science courses that are problem set based where writing is valued but less attention is paid to explicit writing instruction. Students in these courses are provided with instruction in how to write a problem set and are expected to deliver problem sets that meet department expectations for writing. While writing mechanics is not the focus of these courses, students are expected to communicate technical information clearly including problem sets, equations, graphs, tables, charts and sketches. Writing instruction is in the form of acquainting students with available resources on how to write a problem set, including the department's problem set style guide and the instructor making clear in the syllabus and in opening lectures that quality of communication on problem sets is important for the course and

important for the student’s growth as an engineer. The expectation is that in some of the courses, part of the grading for a problem set is based on quality of the writing along with quality of the technical content. The other set of courses in this category are the six senior lab courses. Here students are provided with resources on keeping lab notebooks and writing lab reports, a repetition of skills they learned in the pre-requisite writing intensive course ME4031W. Instructors in the lab courses make it clear that excellent communication in lab reports is essential for success.

Assisting the pillars is the non-discipline specific writing instruction provided by the introductory courses taught outside the department, which includes First Year Writing and physics.

***Aligning Writing Outcomes to the Core Curriculum***

The desired writing abilities listed earlier are the expected outcomes for students graduating in Mechanical Engineering. The table below maps each outcome to one to one or more of the discipline-specific writing characteristics (also described above), to one or more engineering writing products seen in our courses and to the means of assessment that can be used to determine if our students are attaining the expected outcomes.

<b>ABILITY</b>	<b>CHARACTERISTICS</b>	<b>PRODUCTS</b>	<b>ASSESSMENT</b>
Apply knowledge of physics, mathematics, and engineering in their writing	<ul style="list-style-type: none"> <li>▪ efficient in describing and solving problems</li> <li>▪ logical</li> <li>▪ integrates text, numbers and graphics</li> <li>▪ describes complex technical concepts</li> </ul>	<ul style="list-style-type: none"> <li>▪ problem set</li> <li>▪ design report</li> </ul>	<ul style="list-style-type: none"> <li>▪ sampled problem sets from selected engineering science courses</li> <li>▪ ME4054 design report</li> <li>▪ ME4xxx lab report</li> </ul>
Record and analyze activity related to laboratories and design projects	<ul style="list-style-type: none"> <li>▪ data-driven</li> <li>▪ pointed and concise</li> <li>▪ prescribed format</li> </ul>	<ul style="list-style-type: none"> <li>▪ lab notebook</li> <li>▪ lab report</li> <li>▪ design notebook</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME2011 notebook</li> <li>▪ ME2011 lab report</li> <li>▪ ME4031 lab report</li> <li>▪ ME4xxx lab report</li> <li>▪ ME4054 notebook</li> </ul>
Visually represent technical concepts and designs to explain their salient features	<ul style="list-style-type: none"> <li>▪ depiction of spatial objects</li> <li>▪ describes complex technical data and concepts</li> <li>▪ integrates text, numbers and graphics</li> </ul>	<ul style="list-style-type: none"> <li>▪ annotated hand sketch</li> <li>▪ CAD drawing</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME2011 portfolio</li> <li>▪ ME4054 report</li> </ul>
Synthesize and summarize key points	<ul style="list-style-type: none"> <li>▪ pointed</li> <li>▪ concise</li> </ul>	<ul style="list-style-type: none"> <li>▪ abstract</li> <li>▪ executive summary</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME4031 lab report</li> <li>▪ ME4054 design report</li> </ul>
State and explain engineering project metrics such as productivity, costs and time to completion	<ul style="list-style-type: none"> <li>▪ systematic</li> <li>▪ credible</li> </ul>	<ul style="list-style-type: none"> <li>▪ project proposal</li> <li>▪ design report</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME4054 statement of work</li> <li>▪ ME4054 design report</li> </ul>
Analyze the audience and create a document that meets their needs	<ul style="list-style-type: none"> <li>▪ appropriate choices of evidence</li> <li>▪ appropriate use of technical information</li> <li>▪ appropriate style</li> </ul>	<ul style="list-style-type: none"> <li>▪ project proposal</li> <li>▪ design report</li> <li>▪ professional correspondence</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME4054 statement of work</li> <li>▪ ME4054 design report</li> </ul>

Represent themselves professionally through their writing	<ul style="list-style-type: none"> <li>▪ credible</li> <li>▪ clear</li> <li>▪ explanatory</li> <li>▪ correct mechanics</li> </ul>	<ul style="list-style-type: none"> <li>▪ resume</li> <li>▪ cover letters</li> <li>▪ e-mail</li> <li>▪ professional correspondence</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME2011 resume</li> </ul>
Explain, discuss, and demonstrate physical apparatus	<ul style="list-style-type: none"> <li>▪ Explains complex technical concepts</li> <li>▪ concise</li> <li>▪ integrates text and graphics</li> </ul>	<ul style="list-style-type: none"> <li>▪ design report</li> <li>▪ project report</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME4054 design report</li> </ul>
Integrate visual, textual, and oral explanations_	<ul style="list-style-type: none"> <li>▪ efficient</li> <li>▪ persuasive</li> <li>▪ credible</li> </ul>	<ul style="list-style-type: none"> <li>▪ poster</li> <li>▪ multi-media application</li> <li>▪ oral presentation</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME2011 technical presentation</li> <li>▪ ME4054 design review presentation</li> </ul>
Create team-written documents using collaborative authoring tools	<ul style="list-style-type: none"> <li>▪ accurate</li> <li>▪ concise</li> <li>▪ credible</li> <li>▪ collaboratively authored</li> </ul>	<ul style="list-style-type: none"> <li>▪ design report</li> <li>▪ project web site</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME4054 design report</li> <li>▪ ME4054 project web site</li> </ul>
Produce documents in the styles used by professional engineers	<ul style="list-style-type: none"> <li>▪ prescribed format and structure</li> <li>▪ correct mechanicals</li> </ul>	<ul style="list-style-type: none"> <li>▪ design report</li> <li>▪ project plan</li> </ul>	<ul style="list-style-type: none"> <li>▪ ME4054 design report</li> <li>▪ ME4054 project plan</li> </ul>
Write according to style guidelines approved by Mechanical Engineering faculty	<ul style="list-style-type: none"> <li>▪ prescribed format and structure</li> <li>• correct mechanics</li> </ul>	<ul style="list-style-type: none"> <li>▪ all genres</li> </ul>	<ul style="list-style-type: none"> <li>▪ all</li> </ul>

### ***Mechanical Engineering Style Guides***

A set of discipline-specific style guides has been developed to assist students and instructors in assignments that involve writing. The guides include writing problem sets, writing lab reports, writing design reports and writing posters. The guides are non-course specific so that they can be used in any course that requires the genre covered by a guide. While much of the material in the guides can be found in numerous technical writing books, the value of creating our own guides is that they can focus on what is most important to mechanical engineers and they send the message that writing is important in mechanical engineering at the University of Minnesota.

Augmenting the guides are a set of evaluation rubrics that instructors can use for evaluating student writing and students can use to help them understand expectations for their writing.

### ***Training Course Instructors***

The writing program rests on the assumption that while the expectation for high quality writing in a course is set by the faculty member in charge, the majority of the assessment of student work is done by Teaching Assistants (TAs) who for the most part are evaluating student work for technical content. Therefore, the department provides training to all TAs so that they are aware of the department writing program, including the list of writing outcomes. Training also covers how to assess problem sets, lab reports and design reports for writing quality, as well as an introduction to the department style guides. The training occurs during the required TA orientation session that occurs at the start of every semester as well as other sessions during the semester.

### ***Department Writing Standards Web Site***

A department Writing Standards web site has been established. From the Mechanical Engineering home page ([www.me.umn.edu](http://www.me.umn.edu)): Education > Undergraduate Education > Writing Standards. The web site contains a statement on writing, the department writing program (this document), style guides and instructor resources. Instructor resources include grading rubrics, sample statements about writing to include on syllabi and suggestions for

assessing student writing.

### ***University Writing Intensive Requirement***

The University of Minnesota requires all students to complete four writing intensive courses (those with a W designator). Two must be taken at the advanced level, and one of those must be in the major. Mechanical engineering majors typically satisfy the writing intensive requirement by taking the two introductory physics courses and ME 4031W and ME 4054W, both of which are advanced and within the major. There are no plans to change the W status of these two courses.

### ***Transfer Students***

Mechanical Engineering graduates a large number of transfer students who typically enter in the second or third year. The admissions department determines whether they have satisfied first year writing and two writing intensive experience equivalent to the introductory physics courses. Once admitted, transfer students will experience almost the same writing instruction and experience as non-transfer students in the major. The only exception is that many transfer students place out of ME 2011, the only lower division course offered by the department. The writing outcomes expected of transfer students are the same as for non-transfer students.

### ***Connecting Writing to the ABET Accreditation Process***

Every six years the mechanical engineering undergraduate program goes through a comprehensive ABET accreditation process, which involves self-study, a site visit and implementing a process of continuous assessment and improvement. ABET accreditation requires that the program have a set of published educational objectives and outcomes for the program, and a documented assessment processes that demonstrates that the objectives meet the needs of stakeholders and that the objectives are being attained. Several of the ABET-required program outcomes are directly or indirectly connected to the department writing program, including objective (g), an ability to communicate effectively. For example, in a previous self-study, faculty in the department felt that objective (a), an ability to apply knowledge of mathematics, science and engineering, was not adequately achieved in the capstone design course ME 4054W as evidenced by sampling design reports. This led to an increased emphasis on analysis-driven design projects and an explicit requirement to document the design in the report. Writing ability #1 (see above), “apply knowledge of physics, mathematics, and engineering in their writing”, comes directly from ABET objective (a), and is assessed in the same way, by sampling design reports from ME 4054W. In another self-study exercise, faculty felt that several important aspects of the design process were not being communicated in the ME 4054W design reports and recommended changes that were recently implemented. Other parts of the department’s documented process of self-assessment involve sampling exams, reports, design notebooks and other student work. Evaluating the ability of students in the major to communicate is a natural part of the ABET evaluation process.

### **Section 4: ASSESSMENT OF STUDENT WRITING**

*What concerns, if any, have unit faculty and undergraduate students voiced about grading practices?*

*Please include a menu of criteria extrapolated from the list of Desired Writing Abilities provided in Section II of this plan. (This menu can be offered to faculty/instructors for selective adaptation and will function as a starting point in the WEC Project’s longitudinal rating process.).*

- There have not been substantial revisions to this section of the Writing Plan.*
- X There have been substantial revisions to this section of the Writing Plan. (Discuss these explicitly.)*

### ***Course-Based Assessment in Core Writing Courses***

The core writing courses are ME 2011, ME 4031W and ME 4054W. Assessment is used by course instructors for course improvements to rate student writing.

Formative Assessment: Instructors review student work on assignments and use student performance to determine if writing instruction needs modification. In WI courses, instructors provide feedback for revision assignments. Instructors may choose to show exemplary examples of technical writing so that students begin to understand the quality bar. At the end of the course, one or more of the questions related to writing from the optional question bank developed for the Student Rating of Teaching (SRT) are included on the SRT form for the course and used for course improvement.

Summative Assessment: Instructors use rubrics to grade student work on writing assignments. In some cases, an explicit portion of the grade depends on the quality of the writing. Grade-norming sessions are held with instructors in multi-section courses in order to ensure that rubrics are being used similarly across sections and instructors.

### ***Course-Based Assessment in Problem-Set and Senior Laboratory Courses***

Formative Assessment: During grading for technical content, TAs examine student work on problem sets and lab reports for writing quality. If the writing quality is not meeting expected standards, TAs use recitation sections or the instructor uses whole class time to provide additional instruction to students in technical communication standards for problem sets or lab reports. Exemplary examples of technical writing may be shown so that students begin to understand the quality bar.

Summative Assessment: In some cases, graders, using a rubric, use a portion of an assignment grade to evaluate the quality of the writing.

### ***Program-Based Assessment***

The purpose of assessing the department writing program as a whole is to understand whether it is achieving the goal of students attaining the writing abilities listed in this document. Several forms of assessment are used, some of which are tied to the regular evaluation and continuous improvement done as part of the ABET assessment process. The data from program assessment is interpreted by the WEC Liaison and the Director of Undergraduate Studies who in turn can make recommendations to the department faculty for writing program changes. The Liaison also writes a brief evaluation of the writing program for the ABET self-study report. The archived ABET reports allow evaluation of the program over a longer time window.

Writing Samples: Every three years (2015, 2018, ...) a random set of reports from the department capstone design course are drawn from student work and evaluated by a group of internal and external evaluators with the process coordinated by the WEC team. The evaluation uses a rubric with metrics based on the writing abilities listed in Section 2. The triennial sampling aligns with assessment of course material for ABET and with unit assessment by the WEC program.

Stake-Holder Feedback: A small sample of students in the major, department faculty and practicing engineers are interviewed through survey or in-person for comments on all aspects of the degree program, including student writing. Practicing engineers are drawn from the Mechanical Engineering Advisory council. Interviewing is biennial and tied to ABET self-assessment.

Curriculum Survey: Since 1999, well before the writing program started, an opinion survey has been administered to students in ME 2011, when they are near the start of their program, and students in ME 4054, when they are near

the end of their program. The survey includes a question about the importance of writing to the engineering profession. The survey continues to be administered. The data allows a longitudinal assessment to determine if the writing program has impacted student's opinion of writing.

**Section 5: SUMMARY OF IMPLEMENTATION PLANS, including REQUESTED SUPPORT, RELATION TO PREVIOUS IMPLEMENTATION ACTIVITIES, and SUSTAINABILITY PLANS**

*What does the unit plan to implement during the period covered by this plan? What forms of instructional support does this unit request to help implement proposed changes? What are the expected outcomes of named support?*

*How do the implementation plans of the 3<sup>rd</sup> edition Writing Plan relate to implementation activities from the 1<sup>st</sup> and 2<sup>nd</sup> edition Writing Plans? What has been successful? What was not successful? How do implementation plans build on what was learned from the first year of implementation? How do implementation plans anticipate the ongoing application of this final edition Writing Plan?*

*How will the unit move toward ownership of the implementation process after the end of eligibility for WEC funding? When needed, what will be sources of funding and resource support? How will ongoing evaluation and improvement of the Writing Plan take place?*

**Two Year Plan for WEC Initiatives**

Based on faculty input, the periodic review of our curriculum during the ABET accreditation process, the review of the triennial sampling of capstone writing and faculty curriculum workshops, we intend to conduct the following WEC initiatives over the next 24 months. No WEC monetary support is being requested for these activities.

Additional Style Guides. We will create at a minimum two additional style guides. The first will be titled "How to Create a Poster". Posters are used in several ME courses, including ME 4054W, Design Projects, one of the courses targeted for explicit writing instruction. Currently, we have no centralized resources for instructing students on how to create a poster. The second will be titled "How to Write with Figures." This will cover how to create charts that describe experiment data and how to create drawings, renderings and images that describe physical objects. Figures and visuals cut across many of our courses. We will look to other UMN science and engineering departments as well as outside sources to create the guide. Unlike science fields, engineers also create new products and processes, which require conventions of visual communication that are different than experimental data plots, and those conventions will be a part of the guide. The intent is to provide a resource for students in and instructors teaching courses where creating figures is critical to course content. [Completed May, 2017].

Instructor Writing Resources. We will add additional content to the Instructors Writing Resources section of the department writing program web site. Resources will include samples of rubrics used by department faculty to assess writing assignments and five-minute workshop activities related to writing that instructors can use in their courses. [Completed May, 2017].

Improve TA Training. TA training occurs every semester. Currently, writing instruction training is ad hoc. We will work with WEC Staff and with Center for Educational Innovation staff to develop effective modules for TA training. We anticipate that training will occur at periodic times during the semester rather than once at the beginning of the semester. [Completed September, 2017].

Capstone Design Report. The design report from our capstone course is the main indicator used for longitudinal assessment of writing. We will revisit the instruction methods that we use to teach students how to write this group-authored report. We will develop course modules on how to create a multi-authored report and will

implement a practice of peer-evaluation of report drafts. This activity relates to our capstone course, ME 4054. [Completed May, 2017].

### ***WEC Program Sustainability***

The department has assumed ownership of its WEC program and does not require financial assistance for its maintenance.

The following are the components that are required to maintain the program, with all components currently in place.

WEC Faculty Liaison: Responsible for coordinating, maintaining and improving the writing program. Serves as the connection point between the department and the university WEC program.

Faculty Teaching Core Instruction Courses: Faculty in charge of ME 2011, ME 4031W and ME 4054W must be particularly sensitive to the responsibility for providing effective and appropriate writing instruction in the courses. Faculty teaching the two WI courses are responsible for ensuring their course meets the WI criteria.

Faculty Teaching Core Engineering Science and Senior Laboratory Courses: Faculty are encouraged to include significant writing instruction in their courses, to make use of the writing style guides, to include a statement about the importance of writing in the syllabus and to assign a small portion of the grade to quality of writing, even for problem set based courses.

Teaching Assistants: TAs are expected to attend the required training on writing instruction that occurs during TA orientation. TAs are expected to encourage students to maintain high standards for technical writing and to provide assistance in writing to students if requested. TAs in the three core writing courses will be involved in the formal assessment of writing.

University of Minnesota WEC Program: Support from the WEC program is needed to: 1. Review and provide advice about our writing resources, including style guides and grading rubrics. 2. Consult with individual faculty teaching core courses on an as-needed basis. 3. Consult and assist with the “Teaching with Writing in Mechanical Engineering” workshop for department TAs delivered during TA orientation. 4. Coordinate the WEC triennial rating of student writing in the unit

### **Section 6: PROCESS USED TO CREATE THIS WRITING PLAN**

*How, and to what degree, were a substantial number of stakeholders in this unit (faculty members, instructors, affiliates, teaching assistants, undergraduates, others) engaged in providing, revising, and approving the content of this Writing Plan?*

Because changes from second plan were not major, this third revision was circulated to faculty for comment with the changes highlighted. Final edits were made based on faculty comments. Most recently (Sept, 2015), faculty gathered to review and discuss the results from the 2015 triennial writing samples rating.

### **Section 7: CONNECTION TO STUDENT LEARNING OUTCOMES**

*Briefly describe how the ideas contained in this Undergraduate Writing Plan address the University's Student Learning Outcomes (<http://www.slo.umn.edu>).*

The University of Minnesota Student Learning Outcomes define what undergraduate students can do upon graduation. The learning outcomes state that students:

1. Can identify, define, and solve problems
2. Can locate and critically evaluate information
3. Have mastered a body of knowledge and a mode of inquiry
4. Understand diverse philosophies and cultures within and across societies
5. Can communicate effectively
6. Understand the role of creativity, innovation, discovery, and expression across disciplines
7. Have acquired skills for effective citizenship and life-long learning

The desired abilities in the Mechanical Engineering writing plan align with the SLOs as shown in the table.

	Can locate and critically evaluate information	Can identify, define, and solve problems	Have mastered a body of knowledge and a mode of inquiry	Understand diverse philosophies and cultures within and across societies	Can communicate effectively	Understand the role of creativity, innovation, discovery, and expression	Have acquired skills for effective citizenship and life-long learning
Apply knowledge of physics, mathematics, and engineering in their writing	X	X	X		X		
Record and analyze activity related to laboratories and design projects	X	X	X		X	X	
Visually represent technical content and designs to explain their salient features		X	X		X	X	
Synthesize and summarize key points	X				X		
State and explain engineering project metrics such as productivity, costs and time to completion	X	X	X		X		
Analyze the audience and create a document that meets their needs					X		
Represent themselves professionally through their writing					X		X
Explain, discuss, and demonstrate physical apparatus	X	X	X		X		
Integrate visual, textual and oral explanations					X		
Create team-written documents using collaborative authorship tools				X	X		
Produce documents in the styles used by professional engineers			X		X		
Write according to style guidelines approved by mechanical engineering faculty					X		

## V. WEC Research Assistant (RA) Request Form

*This form is required if RA funding is requested. If no RA funding is requested please check the box below.*

No RA Funding Requested

RAs assist faculty liaisons in the WEC Writing Plan implementation process. The specific duties of the RA are determined in coordination with the unit liaison and the WEC consultant, but should generally meet the following criteria: they are manageable in the time allotted, they are sufficient to their funding, and they have concrete goals and expectations (see below).

RA funding requests are made by appointment percent time (e.g., 25% FTE, 10% FTE, etc.). Appointment times can be split between two or more RAs when applicable (e.g., two 12.5% appointments for a total of 25% FTE request). Total funds (including fringe benefits when applicable) need to be calculated in advance by the liaison, usually in coordination with administrative personnel<sup>i</sup>.

Please note that, outside of duties determined by the liaison, WEC RAs may be required to participate in specific WEC activities, such as meetings, Moodle discussion boards, and surveys.

RA Name (Use TBD for vacancies): \_\_\_\_\_

RA Contact Information: email \_\_\_\_\_, phone \_\_\_\_\_

Period of appointment (Semester/Year to Semester/Year):

RA appointment percent time:

Define in detail the tasks that the RA will be completing within the funding period:

Define deadlines as applicable (please note that all deadlines must be completed within the funding period):

Describe how frequently the RA will check in with the liaison:

Describe in detail the RA's check-in process (e.g., via email, phone, in-person, etc.):

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<sup>i</sup> An example for determining funding for appointments can be found on the WEC Liaison Moodle. This is for planning and example purposes only and cannot be used to determine final budget items for the Writing Plan.

## VI. WEC Writing Plan Requests

Unit Name: **Mechanical Engineering**

**Financial Requests** (requests cannot include faculty salary support) *drop-down choices will appear when cell next to "semester" is selected*

**Total Financial Request:** **\$0.00**

Semester 1:		Semester 2:		Semester 3:	
Item	Cost	Item	Cost	Item	Cost
Semester 1 Total:		Semester 2 Total:		Semester 3 Total:	
\$0.00		\$0.00		\$0.00	

### Rationale for costs and their schedule of distribution

No financial support is requested.

**Service Requests** *drop-down choices will appear when a cell in the "service" column is selected*

Semester 1:		Semester 2:		Semester 3:	
Service	Qty	Service	Qty	Service	Qty
Consultation	1	Consultation	1	Consultation	1

### Description and rationale for services

One consultation with WEC staff per staff to assist in implementing the plan.

Semester 4:

Semester 5:

Semester 6:

Item	Cost	Item	Cost	Item	Cost

Semester 4 Total: \$0.00

Semester 5 Total: \$0.00

Semester 6 Total: \$0.00

Semester 4:

Semester 5:

Semester 6:

Service	Qty	Service	Qty	Service	Qty
Consultation	1	Consultation	1	Consultation	1

March 10, 2016

Will Durfee  
Mechanical Engineering  
wkdurfee@umn.edu

Dear Will,

I write to let you know that the Campus Writing Board recently discussed and approved the Writing Plan submitted by you on behalf of the Department of Mechanical Engineering.

Because you have not requested any additional funding, this plan is fully approved and requires no further consideration by the Campus Writing Board or Office of Undergraduate Education. Best wishes going forward.

Sincerely,

A handwritten signature in cursive script that reads "Rachel".

Rachel Rodrigue  
Staff, Campus Writing Board  
webe0354@umn.edu  
612-624-1328

CC: Molly Bendzick, Dan Emery, Pamela Flash, Sarah Hobbie, Leslie Schiff