ABET
Self-Study Report

for the

Mechanical Engineering
Bachelor of Science Program

at

Oregon Institute of Technology

Main Campus: Klamath Falls, OR
Satellite campus for Boeing employees: Seattle, WA

July 1, 2016

CONFIDENTIAL

Program Self-Study Report
for
EAC of ABET
Accreditation or Reaccreditation

BACKGROUND INFORMATION

A. Contact Information

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http://www.oit.edu/academics/degrees/mechanical-engineering

B. Program History

The Mechanical Engineering (ME) Program at Oregon Institute of Technology (OIT) was implemented in fall 2005. It gained initial accreditation by the Engineering Accreditation Commission (EAC) of ABET in fall 2009. Subsequently the program was visited in 2011 and its accreditation continued. The accreditation of the ME program was extended to the OIT campus in the Seattle, WA area in 2013.

The Manufacturing and Mechanical Engineering and Technology (MMET) Department also houses three technology programs. These include Bachelor of Science degrees in Mechanical Engineering Technology and Manufacturing Engineering Technology, both with long standing ETAC of ABET accreditation, and a Master's of Science degree in Manufacturing Engineering Technology. The engineering technology degrees are offered at the main campus in Klamath Falls as well as in Wilsonville, OR and at the Seattle, WA campus.

A few minor changes to the BSME program have taken place since our last ABET visit; these changes include:

- The chemistry requirement has changed from CHE 221 (5 credits) and CHE 222 (5 credits); to CHE 201/204 (4 credits) and CHE 202/205 (4 credits). This is a decrease in 2 credits of Math and Basic Science courses.

- MATH 321 (Differential Equations) and MATH 341 (Linear Algebra I) have changed from 3-credit courses to 4-credits; this is an increase in 2 credits of Math and Basic Science.
- Freshman orientation has changed from MET 111 (2 credits) and MET 112 (2 credits), to ENGR 111 (2 credits). This is a drop in 2 total credits.
- ENGR 485 Fundamentals of Engineering Exam (1 credit) has been dropped from the curriculum.
- A fourth 3-credit MECH senior elective has been added.

The total number of credits (192) is the same.

C. Options

There are no options or tracks offered within the Mechanical Engineering Program

D. Program Delivery Modes

The delivery mode on the Klamath Falls (KF) Campus until recently has used the traditional lecture/lab weekday delivery of all courses. Starting in the fall of 2015 the required courses MECH 315 Machine Design I (and in the winter 2016 quarter MECH 316 Machine Design II) are being delivered via distance using the Blackboard LMS.

In Seattle the mode is traditional lecture/lab delivery. All of the students are working professionals within the Boeing Company so the majority of courses are offered in the late afternoon or evening and in some cases on the weekends. Some independent study elective courses may be offered via distance delivery using Boeing's internal web services.

E. Program Locations

Include all locations where the program or a portion of the program is regularly offered (this would also include dual degrees, international partnerships, etc.).

The four MMET programs, Manufacturing Engineering Technology (MFG), Mechanical Engineering Technology (MET), Mechanical Engineering (ME), and the Master of Science in Manufacturing Engineering Technology (MS MFG) reside in three locations. The main or home campus is in Klamath Falls, Oregon. The second campus, primarily catering to the working professional, is located in Wilsonville, Oregon and is commonly referred to as the Urban campus. The third location is in Seattle, Washington, established at the Boeing facility for their employees. The total MMET Department student head count has grown from 353 in 2009 to 551 in the fall of 2015 students. The breakdown of programs and degrees offered at these three sites are as follows:

Klamath Falls Campus
Manufacturing Engineering Technology (MFG)
Mechanical Engineering Technology (MET)
Mechanical Engineering (ME)
Masters in Manufacturing Engineering Technology (MS MFG)

Wilsonville Campus
Manufacturing Engineering Technology (MFG)
Mechanical Engineering Technology (MET)

Masters in Manufacturing Engineering Technology (MS MFG)

The Mechanical Engineering Program was approved in early 2016 by the Oregon Tech Board to be offered at the Wilsonville campus by extension, and 3 faculty members are currently being recruited to staff this program. The BSME program at Wilsonville has received State approval to start offering courses Fall of 2016; at the time of this report the actual start date has not been determined.

Since there are many common courses between Oregon Tech's BSME and BSMET program; and our BSREE program offered at the Wilsonville campus also contains several upper-division MECH courses; some Mechanical Engineering students from the Klamath Falls campus have taken courses at the Wilsonville campus. However, these students are Klamath Falls students, and will graduate from the Klamath Falls campus.

Seattle Campus
Manufacturing Engineering Technology (MFG)
Mechanical Engineering Technology (MET)
Mechanical Engineering (ME)
Masters in Manufacturing Engineering Technology (MS MFG)

F. *Public Disclosure*

In compliance with ABET's requirements regarding public disclosure of information (APPM, section II.A.6), the BSME program website(http://www.oit.edu/academics/degrees/mechanical-engineering and catalog http://www.oit.edu/docs/default-source/general-catalog/2015-16-catalog.pdf , pages 107 through 109) indicate that the BSME program is "accredited by the Engineering Accreditation Commission (EAC) of ABET, Inc., http://www.abet.org".

PEO's: http://www.oit.edu/faculty-staff/provost/learning-outcomes/mechanical-engineering

And catalog: http://www.oit.edu/docs/default-source/general-catalog/2015-16-catalog.pdf

SO's: http://www.oit.edu/faculty-staff/provost/learning-outcomes/mechanical-engineering

And catalog: http://www.oit.edu/docs/default-source/general-catalog/2015-16-catalog.pdf

Annual student enrollment: http://www.oit.edu/faculty-staff/provost/learning-outcomes/mechanical-engineering as well as the website for the university's Office of Institutional Research (http://www.oit.edu/faculty-staff/institutional-research).

Graduation data: http://www.oit.edu/faculty-staff/provost/learning-outcomes/mechanical-engineering as well as the website for the university's Office of Institutional Research (http://www.oit.edu/faculty-staff/institutional-research).

G. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

OIT's mechanical engineering program had its most recent ABET accreditation visit in fall of 2010. The result of this visit was continued accreditation to September 30, 2017. The Final Statement from ABET noted two concerns. Those concerns are listed below along with the actions taken by the program to address them. Note that during this visit the program was only accredited at the Klamath Falls campus.

Program Concerns:

1. <u>Criteria 2. Program Educational Objectives</u> Criteria 2 requires that a program must have published educational objectives that are consistent with the mission of the institution and the accreditation criteria. Program educational objectives are defined as broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. The program has solicited input from its constituencies and developed five program educational objectives. The first of the published program educational objectives does not describe accomplishments that the program is preparing the graduates to achieve but rather the ability to achieve those accomplishments. While there is compliance with the development of the program educational objectives, better articulation of the first objective is needed so that assessment can ensure continued compliance. Criterion 2 also requires an assessment and evaluation process that periodically documents and demonstrates the degree to which each objective is attained. The program is currently in compliance with this requirement in that they are assessing achievement of the program educational objectives with surveys of alumni and employers. The alumni survey provided assessment data used to demonstrate the degree to which objectives were achieved. However, the employer survey included data from both mechanical engineering and mechanical engineering technology graduates that were not disaggregated by program. The program needs to refine the employer survey so data on mechanical engineering graduates are separated from data on mechanical engineering technology graduates for it to be more useful in the assessment process. The data from the employer survey could then be better used to help ensure continued compliance of the program educational objectives.

This concern was addressed through the program's assessment activities. During the 2011-12 assessment cycle the Program Educational Objectives were reviewed and modified. The new program Mission and Objectives are:

Mechanical Engineering Program Mission Statement

The Mechanical Engineering Program at Oregon Institute of Technology is an applied engineering program. Its mission is to provide graduates the skills and knowledge for successful careers in mechanical engineering.

Mechanical Engineering Program Educational Objectives

The program expects graduates to achieve, within several years of graduation, the following objectives. Mechanical Engineering graduates will have

- *demonstrated the ability to analyze, design and improve practical thermal and/or mechanical systems.*
- *shown the ability to communicate effectively and work well on team-based engineering projects.*

- *succeeded in entry-level mechanical engineering positions regionally and nationally.*
- *pursued continued professional development, including professional registration if desired.*
- *Successfully pursued engineering graduate studies and research, if desired.*

These were reviewed by the faculty and by the Industrial Advisory Council. The general thrust of the objectives was changed little, but they now better express their outlook as suggested in the last ABET visit. We are currently making minor changes to our PEO's; this revision should be in place fall 2016.

The employer survey is no longer required to verify compliance with the Program Educational Objectives; it is just used to review the PEO's. We plan to give our next employer survey in 2017; at this time we will make sure to separate out input for the Mechanical Engineering program from the inputs for the MET and MFG programs that are also offered in the MMET Department at Oregon Tech.

1. <u>Criterion 6. Faculty</u> Criterion 6 requires that there must be a sufficient number of faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students. The program has a commitment from one new faculty member who is coming in January 2011 and approval for a search for one more faculty member. These two faculty members along with existing faculty are adequate for the current number of students in the program. However, if the program continues to grow as rapidly in the next five years as it has in the past five, the number of faculty members should be increased to maintain the smaller class sizes and quality faculty-student interaction that now attracts students to the program.

At the Klamath Falls campus we were able to hire the two new faculty members indicated in the last Self Study. Sean Sloan arrived in January 2011 and Jeff Hayen started September 2011. In 2014 an additional tenure-track faculty position was added at the Klamath Falls campus; and in the fall of 2016 and additional ½ faculty position will be filled. At our Seattle campus an additional tenure-track faculty position was added in 2014. The BSME Degree program is the largest Engineering program at the Oregon Institute of Technology. If the enrollment continues to increase then additional full-time tenure track faculty members may be required at the Klamath Falls campus; at the Seattle campus the increase in student headcount can probably be met by hiring additional adjuncts.

GENERAL CRITERIA

CRITERION 1. STUDENTS

Criteria for students are shown below, with written policies shown in Appendix E. Please note that effective July 1, 2015, Oregon Institute of Technology (Oregon Tech) became a separate legal entity from the Oregon University System and now operates under its own Board of Trustees. With the dissolution of the OUS System many of the Oregon Administrative Rules (OARs) specific to Oregon Tech and higher education in general were repealed.

Former OARs in Chapter 578, specific to Oregon Tech, were effectively readopted as Oregon Tech University Policies in substantially identical form on July 1, 2015. For convenience, until all policies are reviewed, the University Policies that were previously OARs will maintain their previous OAR numbers, without the “OAR” designator.

Chapter 580 of the OARs, previously promulgated by the State Board of Higher Education (BSHE), were also effectively readopted as University Policies in substantially identical form on July 1, 2015. They are now also incorporated into the University Policies, retaining their previous OAR numbers without the “OAR” designator.

In addition, SBHE Internal Management Directives (IMDs) and board policies were also effectively readopted as Oregon Tech University Policies in substantially identical form on July 1, 2015.
To interpret the Policies during this transition period, note that “Board” or “State Board of Higher Education” now refers to Oregon Tech’s Board of Trustees; “Chancellor” means “University President;” “Institution” means Oregon Tech; and so on.

Since it is proving to be very complicated to attach these policies; only Oregon Tech policies are attached in the Appendix. The applicable portions of the former OUS policies are reproduced in the OIT catalog, and the appropriate pages are referred to below. Further information may be found at the following website: http://www.oit.edu/faculty-staff/human-resources/policies/former-oars-imds

A. Student Admissions

There are no requirements to enter the ME program beyond that of the institution. The institution requires a minimum of an un-weighted cumulative high school grade point average of 3.00. Applicants with a GPA between 2.50 and 2.99 may qualify for admission provided they submit adequate SAT Reasoning Exam scores or ACT scores. Further details are available in OIT’s 2015-16 catalog starting on page 12.

Students pursuing degrees at the Seattle campus are held to the same entry requirements that students on the main campus in Klamath Falls are. The majority of Seattle students have their tuition reimbursed by Boeing. Boeing requires employment of at least one year for tuition reimbursement, although there are some exceptions.

B. Evaluating Student Performance

All students working towards a degree at OIT are held to the same requirements. Those requirements apply to students in Seattle as well as in Klamath Falls. The 2015-16 OIT catalog lists these Institution requirements starting on page 27. These include Grading Policy, Drop/Withdraw Policy, Assigning an Incomplete Grade, Grade Point Average, In Progress Grades, Academic Honors, Repeat and Auditing Policies, and Substitutions.

Students pursuing a Mechanical Engineering degree at our Seattle campus will have the same requirements that students in Klamath Falls have. Boeing employees, who the extension to Seattle is to serve, have their tuition reimbursed by Boeing as noted above.

Grading of student work and course grades are given by the Professor in charge of each course. Part of the program's assessment effort is to maintain consistency between courses delivered in Seattle and on the main campus in Klamath Falls. In addition, the faculty at both locations reviews syllabi, textbooks and course content to assure consistency between sites.

One OIT practice that helps monitor student progress is meeting with a faculty advisor at least once a term to plan a schedule of classes for the upcoming term(s). At that time, faculty review the progress of the student toward their degree and can use a systems tool called a “Degree Audit” to check for courses that still need to be taken in each area including Humanities/Social Science, Natural Science, Math and Degree Specific. This tool will be discussed later in the report.

Prerequisite issues are looked at carefully on a student-by-student basis. Forms provided by the registrar are filled out by the faculty advisor and reviewed by the department chair to make sure they are given consideration and close scrutiny. It is called a Prerequisite Override form. One of the questions on the form asks the advisor/faculty to give a specific and detailed reason as to why a student is being allowed to register for a class without having fulfilled all the requirements. The advisor often uses the information available on-line such as student transcripts, transfer credit evaluations, course descriptions from other institutions, etc. to make the final determination. If prerequisites are not met, students are directed to complete the required course or attempt to test out of it.

C. Transfer Students and Transfer Courses

The Oregon Tech policy for transfer credits is OIT 13-011, and is shown in Appendix E. In order for OIT to accept transfer credit, the institution where the transfer credit was earned must be accredited by an accrediting body recognized by the Council for Higher Education (CHEA).

Students transferring work from an institution that is not accredited by a CHEA recognized accrediting body may receive transfer credit by 1) demonstrating prior experiential learning with a portfolio, 2) applying for credit after demonstrating competencies in advanced coursework in the same subject area or 3) challenging courses by exam.

Students seeking transfer credit from international institutions must provide OIT with a credential evaluation from an OIT-approved credential evaluation service. Credential evaluation information may be obtained from the Office of Admissions. The credential evaluation must include course titles, credits and grades. Students must also provide course descriptions in English from the international institution. Any associated costs are the responsibility of the student.

Prior to the formal awarding of transfer credit, the transfer student must provide an official transcript of coursework completed at all other higher education institutions. Failure to list all colleges attended on the Application for Admission may result in denial of admission or transfer credit. Admitted transfer students must submit official transcripts at least one term prior to enrollment to ensure timely evaluation of transfer credits.

The OIT Registrar's Office determines the transfer equivalency of general-education courses using articulation agreements, course descriptions, course outlines, and course syllabi. The student's major department determines the transfer equivalency for technical or major courses using similar resources.

The MMET department advising coordinator and program directors consult with each other to determine transferability of courses not covered by articulation agreements. Sometimes a student's knowledge is tested to determine placement within the program's core classes. The student then has the option of receiving credit for the course by completing the credit by examination process or substituting an additional OIT course.

Typically students in Klamath Falls are coming from high school or transferring from a community college within the state. In Seattle that is not the case. Most of the students entering the program have transfer credits from a wide range of schools. The same evaluation takes place but the process is more complex and time consuming in Seattle.

D. Advising and Career Guidance

There is one Advising Coordinator, Irina Demeshko, for the MMET Department on the Klamath Falls campus. She assigns advisors to the students when they start in the program. All teaching faculty that have been through OIT Advisor Training classes serve as advisors. An attempt is made to keep the advising load fairly even and averages about 30 students per faculty. Students may request an advisor change at any time. The MMET advising coordinator is the only departmental personnel with permission to change a students' major or their advisor within the department.

Student advising in Seattle is done by the two full time faculty there, and the Oregon Tech Seattle Program manager. Each student is assigned to one of these faculty/staff members. Since classes at Boeing are taught at two locations, office hours are set for each location, and also individual meeting times are scheduled as requested. There are about 150 active students in the Seattle programs, so each advisor has some 50 advisees. The Seattle students are part time so the higher number of advisees per faculty/staff member in Seattle doesn't translate into an equivalent increase in advising work.

Career and professional guidance is done both by faculty and through the campus Career Services Center. Faculty members hear of opportunities for internships and also announce career fairs or dates that specific companies will be on campus for interviews. The Career Services Office supports student and alumni efforts to develop and achieve career goals. Services include: individual career advising; workshops and classroom presentations on resume writing, job interviewing, job search and applying to graduate school; on-campus employer recruitment, whereby companies and government agencies interview students for career and internship opportunities; Career Fairs, which bring employers and students together on campus to discuss career opportunities informally; career-resource materials and job listings; and a resume referral service, which supports student applications for employment and graduate school.

Career Services also coordinates the Student Employment Service, which provides part-time employment for students both on and off campus with local employers. Positions are available through the College Work-Study program or through regular employment.

E. Work in Lieu of Courses

Credit for prior learning by a student admitted to Oregon Tech may be granted through a number of independent processes. These include: A) Transfer Credit; B) Military Credit; C) College Level Examination Programs (CLEP) and Advanced Placement credit (AP); D) Credit for National Registry or Licensure Exams; E) Credit by Examination; and F) Credit for Prior Experiential Learning.

A number of these categories are for credit that is awarded for educational accomplishments attained outside of accredited post-secondary institutions. Oregon Tech recognizes that students learn outside the classroom through experiences on the job, vocational education, professional development courses, workshops, and independent study. Oregon Tech may grant credit for experiential learning when it is judged to be equivalent to college-level courses in the Oregon Tech curriculum. This process is only appropriate for students who wish to demonstrate learning for more than one required course. Typically, credit for experiential learning will replace a series of major specific courses. Find more information on all OIT policies related to prior learning in the 2015-2016 catalog on pages 24-26. The Oregon Tech policy on these procedures is OIT 13-013, shown in Appendix E.

Students may also take the course MECH 404 Co-op Field practice for one of their mechanical engineering electives. Students must work at least 3 months full-time in an engineering internship; the prerequisite for the course is instructor permission. Prior to taking this course, students must meet with the course instructor and outline the work they will be doing on their internship to make sure that it meets the requirements for an engineering internship. As part of this course, students must write a 10+ page technical paper on their work as an engineering intern; this paper must be approved by the company before it is released.

F. Graduation Requirements

The requirements for graduation with the degree of Bachelor of Science in Mechanical Engineering at Oregon Tech are established at an institutional level and are described in detail on pages 29-32 of the 2015-16 catalog. The Oregon Tech policy on graduation requirements is OIT 15-011, and is shown in Appendix E. An on-line tool available across all campuses called the “Degree Audit” is used by faculty to ensure that all requirements for graduation have been met by the student. The application is completed and submitted 1-2 terms prior to the expected graduation date. Advisors and Program Directors work closely with students who are going through the final stages of completing their degree to review for problems. The requirements and process for graduation is the same for Seattle students as for students on the Klamath Falls campus. Graduation petitions for all locations are processed and approved by the Registrar's Office in Klamath Falls.

G. Transcripts of Recent Graduates

Transcripts for both Klamath Falls and Seattle students will be provided.

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

As defined by ABET, Program Educational Objectives (PEOs) are broad statements that describe what graduates are expected to attain within a few years after graduation. Program educational objectives are based on the needs of the program's constituencies.

To comply with ABET EAC accreditation standards, the BSME program has published PEOs that are consistent with the mission of the institution, the needs of the program's various constituencies, and the ABET criteria. The BSME's PEOs are published both in the catalog as well as the program website. Additionally, there is a documented and effective process, involving program constituencies, for the periodic review and revision of these PEOs.

A. Mission Statement

The mission statement for the Oregon Institute of Technology is published on the Oregon Tech website (http://www.oit.edu/visitors-info/about/mission-statement) as follows:

> "Oregon Institute of Technology, a member of the Oregon University System, offers innovative and rigorous applied degree programs in the areas of engineering, engineering technologies, health technologies, management, and the arts and sciences. To foster student and graduate success, the university provides an intimate, hands-on learning environment, focusing on application of theory to practice. Oregon Tech offers statewide educational opportunities for the emerging needs of Oregon's citizens and provides information and technical expertise to state, national and international constituents."

> Please note that there is a slightly different version of the mission statement for the Oregon Institute of Technology shown on page 6 of our 2015 – 2016 catalog (http://www.oit.edu/docs/default-source/general-catalog/2015-16-catalog.pdf):

> "Oregon Institute of Technology offers innovative and rigorous applied degree programs in the areas of engineering, engineering technologies, health technologies, management, and the arts and sciences. To foster student and graduate success, the university provides an intimate, hands-on learning environment, focusing on application of theory to practice. Oregon Tech offers statewide educational opportunities for the emerging needs of Oregon's citizens and provides information and technical expertise to state, national, and international constituents."

The difference between the two versions of the University's mission statement is the phrase ..."a member of the Oregon University System…" Oregon Tech is no longer a member of the Oregon University System, so the statement shown in our 2015 – 2016 catalog is more correct; however this version has not been voted on by the Oregon Tech Board of Trustees.

B. Program Educational Objectives

Program educational objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. They are generally thought of as desired alumni achievements between three and five years after graduation. The Program Educational Objectives of OIT's mechanical engineering program are established to produce graduates who will have:

- demonstrated the ability to analyze, design and improve practical thermal and/or mechanical systems.
- shown the ability to communicate effectively and work well on team-based engineering projects.
- succeeded in entry-level mechanical engineering positions.
- pursued continued professional development, including professional registration if desired.
- successfully pursued engineering graduate studies and research if desired.

These PEOs may be found at the following websites: PEOs: http://www.oit.edu/faculty-staff/provost/learning-outcomes/mechanical-engineering, and in the Oregon Tech catalog: http://www.oit.edu/docs/default-source/general-catalog/2015-16-catalog.pdf.

These PEOs are being slightly revised during the 2015 – 2016 academic year; the revised version will be available fall 2016.

C. Consistency of the Program Educational Objectives with the Mission of the Institution

The mission statement of the ME Program is in line with and built upon the mission statement of the Institution. This is evident by comparing the Program Mission Statement with the Institution's Mission Statement given previously. The intent of the ME Program in providing an applied mechanical engineering education is directly in line with the Institution mission statement.

D. Program Constituencies

Constituents are those having an interest in the resulting graduate's education. The constituents of the Mechanical Engineering Program include:

- Faculty
- Graduate Schools
- Alumni
- Industry Advisory Committee
- Industry/Employers

E. Process for Review of the Program Educational Objectives

The ME Program at Oregon Tech follows a three year assessment cycle. Each three years all Student Learning Objectives are assessed at least once. This assessment cycle is described in detail elsewhere in this report. Within the assessment plan are provisions for review and revision of the Program Educational Objectives (PEOs). In brief, in the first year of the assessment cycle the PEOs are reviewed by the faculty and by the program's Industrial Advisory Council (IAC) to make sure that they are in line with the mission of the institution, ABET requirements, and of the mechanical engineering constituents. If they are found to need revision the faculty drafts those revisions. They are then reviewed by the IAC with modifications being made as appropriate. Once the faculty and IAC are satisfied with the new draft PEOs they go out to a larger cross section of our constituencies for review and possibly further revision.

Also, each fall term the MMET Department holds a day-long retreat to discuss the program curriculum. If any changes to the curriculum are proposed, they are reviewed in relationship to how they affect the PEOs.

Proposed changes are also reviewed with the Mechanical Engineering Industry Advisory Council (IAC); which normally meets with the faculty twice a year (fall and spring terms).

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes

The ME program's Student Learning Outcomes are aligned with ABET EAC outcomes, and are located at: http://www.oit.edu/faculty-staff/provost/learning-outcomes/mechanical-engineering.

These are stated as:
(a) an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design and realize a physical system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(m1) Graduates will be able to work professionally in the area of thermal systems
(m2) Graduates will be able to work professionally in the area of mechanical systems.

These outcomes mirror those of the EAC of ABET. Outcomes (a) and (c) have been slightly modified to better represent ABET's Mechanical Engineering program specific criteria. Also, outcomes (m1) and (m2) have been added also to address ABET's Mechanical Engineering program specific criteria.

Appendix G contains a series of tables showing the entire BSME curriculum, and where each outcome is introduced (I), reinforced (R), and emphasized (E).

B. Relationship of Student Outcomes to Program Educational Objectives

The ME Program's SLOs are directly related to the Program's Educational Objectives. The mapping of SLOs to PEOs is shown in Table 3.1 below.

> *PEO 1: Demonstrated the ability to analyze, design and improve practical thermal and/or mechanical systems*

PEO 2: Shown the ability to communicate effectively and work well on team-based engineering projects
PEO 3: Succeeded in entry-level mechanical engineering positions.
PEO 4: pursued continued professional development, including professional registration if desired
PEO 5: successfully pursued engineering graduate studies and research if desired

Outcome	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5
Outcome a	X		X	X	X
Outcome b	X		X	X	X
Outcome c	X		X	X	
Outcome d		X	X		
Outcome e	X		X	X	X
Outcome f		X	X		
Outcome g		X	X		
Outcome h			X		
Outcome i				X	X
Outcome j			X		
Outcome k	X		X	X	X
Outcome m1	X		X	X	X
Outcome m2	X		X	X	X

Table 3.1 BSME Student Learning Outcome mapping to Program Educational Objectives

CRITERION 4. CONTINUOUS IMPROVEMENT

A. *Student Outcomes*

The following material is taken from the annual BSME assessment reports. The full reports are located on the Oregon Tech website, and may be found at the following location: http://www.oit.edu/faculty-staff/provost/learning-outcomes/mechanical-engineering

A description of direct assessments administered for each outcome including expected level of attainment and results follow. In addition, summaries of faculty evaluation of these targeted assessments are included for each assessment activity. These summaries are shown in chronological order, starting with the 2010 – 2011 academic year; the summaries are shown first for the Klamath Falls campus, followed by the Seattle campus. Note that the Seattle campus started offering the BSME program in the 2013 – 2-14 academic year. The direct assessments are shown first, with the indirect assessments following.

The faculty use a three-year assessment cycle for the program's student learning outcomes as shown in Table 4.1 below. The goal of the assessment cycle is each time an outcome is assessed that we perform two direct assessments and one indirect assessment. The direct assessments vary by outcome, instructors, and the course where they are applied. Normally all of the students in the course are assessed. Examples include using tests, homework assignments, presentations, design projects, and discussion groups. The indirect assessment is the same for all outcomes; the students in their third term of Senior Projects are given an on-line survey to rate how they performed one the outcomes under consideration that year.

Each direct assessment assignment is evaluated using the appropriate Rubric (shown in Appendix F). After the assignment is assessed, the instructor fills out a summary EXCEL worksheet and uploads it to the Oregon Tech server in a folder for the BSME Assessment documents. The student work is then scanned to PDF format, and these student work files are also uploaded to the BSME Assessment folder. At the end of Spring term the BSME Assessment coordinator compiles the results into the BSME Assessment Report. The yearly reports are then reviewed by the Oregon Tech Director of Assessment, and finally uploaded to the Oregon Tech website at the following address: http://www.oit.edu/faculty-staff/provost/learning-outcomes/mechanical-engineering

At the end of each academic year the MMET Department holds a Closing-the-Loop Assessment meeting. The purpose of the meeting is to review the results of the yearly assessments, make recommendations for changes in courses/curriculum, and to "close-the-loop" on any changes made the previous year(s).

Student Learning Outcome	2015-16	2016-17	2017-18
(a) an ability to apply knowledge of mathematics, science, and engineering			x
(b) an ability to design and conduct experiments, as well as to analyze and interpret data		x	
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability			x
(d) an ability to function on multidisciplinary teams	x		
(e) an ability to identify, formulate, and solve engineering problems			x
(f) an understanding of professional and ethical responsibility	x		
(g) an ability to communicate effectively		x	
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	x		
(i) a recognition of the need for, and an ability to engage in life-long learning		x	
(j) a knowledge of contemporary issues		x	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for		x	

engineering practice			
(m1) Graduates will be able to work professionally in the area of thermal systems			x
(m2) Graduates will be able to work professionally in the area of mechanical systems.			x

Table 4.1. Assessment Cycle

The summaries from each outcome are shown below. Note that some assessments in the 2015 – 2016 academic year are taking place during spring term 2016. Due to timing of this report, several of these assessments may not be finished in time for inclusion. This material will be made available as an addendum during the Fall 2016 campus visit, and will be presented with the other display materials.

SLO a; an ability to apply knowledge of mathematics, science, and engineering

Klamath Falls Assessment, 2011 – 2012 Academic year.
Assessment Method: Pre-Exams

Faculty of the ME program administer "Pre-Exams" in selected junior level mechanical engineering courses. These pre-exams evaluate a cross section of the prerequisite mathematics, science and core engineering knowledge needed in the ME program. They will indicate to the instructor and students what prerequisite material, if any, needs review and in general indicate how effective the mathematics, science and core engineering courses are. These entry exams were given in the following courses shown on Table 4.2.

Table 4.2 2011 2012 BSME Pre-Exams.

Course	*Performance Criteria*
MECH 315 Machine Design I	1, 3
MECH 318 Fluid Mechanics I	1, 2
MECH 480 Vibrations	4

Each set of pre-exams were reviewed by the faculty member giving that exam using an analytic rubric. There was a proficiency scale from 1 to 4 and the "minimum acceptable performance" was determined to be 80% of the students scoring 3 or 4.

Table 4.3 shows the results from pre-exams in MECH 315, MECH 318 and MECH 480. Results from the last assessment, 2009, are given along with the current assessment. The number of students represented in the data is given below the course numbering in parenthesis.

Table 4.3: Assessment Results for SLO A

	2009 Assessment			2012 Assessment		
Performance Criteria	MECH 315	MECH 318	MECH 480	MECH 315	MECH 318	MECH 480

	(7)	(23)	(11)	(24)	(9)	(19)
Apply math principles to an engineering problem	86%	100%	73%	92%	89%	74%
Apply scientific principles in engineering problem(s)	71%	100%	27%	88%	78%	95%
Apply engineering principles in engineering problem(s)	86%	74%	55%	83%	78%	84%
Apply appropriate engineering tools to an engineering problem	100%	100%	N/A	N/A	89%	N/A

The graded Pre-Exams and faculty rubric evaluations have been retained in electronic form. They are kept on a shared drive at OIT and available to OIT faculty and staff.

Assessments from 2012 are much more consistent than from 2009. It is hoped this is due to faculty becoming more familiar with the assessment process and forming more consistent expectations. The data is not extensive enough to show this however.

Some refinement regarding the assessment tools may be indicated. The last SLO is noted as being inapplicable for both MECH 315 and MECH 480. The faculty member assessing these interpreted the SLO to involve engineering tools, primarily computer usage. He felt these could not be assessed in the Pre-Exams used here.

Three evaluations fell below our 80% criteria. However, there is no consistency to where these occurred and they fell close to 80%. Overall the results are considered good.

Klamath Falls Assessment, 2011 – 2012 Academic year.
Assessment Method: MMET Senior Survey Indirect Assessment

As part of the ME capstone course students were asked to complete a senior survey. The data represents assessment done during spring term 2011 and was accomplished using Survey Monkey. Ten ME students responded to the survey,. 70% graduating spring term 2011, 10% in fall 2011, and 20% graduating winter 2012. 80% reported a GPA above 3.0 with 40% reporting GPA above 3.5. 50% are planning to obtain their mathematics minor. Only 10% participated in a MECOP internship. 90% felt their education prepared them to take the FE Exam, however the survey did not attempt to break this down further. Each respondent was asked to judge how well their education prepared them in each SLO.

30% of the responding students transferred in 9 or less credits. 50% started mathematics at algebra or trigonometry while 50% started in differential calculus or above. For this particular SLO, “mathematics, science, and core engineering”, 60% felt highly prepared and 40% felt prepared. No respondents reported feeling inadequately prepared.

Klamath Falls Assessment, 2011 – 2012 Academic year.
Assessment Method: Fundamentals of Engineering Exam Direct Assessment

The Fundamentals of Engineering Exam is taken by all ME students the term before graduation. The results from the spring 2012 exam will not be known until summer 2012. Thus results from the prior year's exam, spring 2011, are used here. The data represents eight students who took the exam in spring 2011. The prior year's results, spring 2010 are also represented for the eight students taking that exam. Results from the previous assessment, 2009, are included for reference. Note that only three students are represented by the 2008 data.

Results from the FE Exam are broken down into disciplines. Those relevant to math, science and core engineering are tabulated in Table 4.4. This data represents eight students who took this exam.

FE Exam results in mathematics, science and core engineering are, in general, slightly below the national average. 2011 shows results very similar to the prior year's. Three students sat for the exam in 2008, two in 2010 and 8 in 2011. Falling below the national average is of concern but may be due to the program's requirement that all students sit for the exam.

Table 4.4: FE Math, Science & Core Engineering Results

<table>
<tr><th></th><th colspan="2">Spring 2008 Exam</th><th colspan="2">Spring 2010 Exam</th><th colspan="2">Spring 2011 Exam</th></tr>
<tr><td>Discipline</td><td>OIT ME (3)</td><td>National Avg.</td><td>OIT ME (2)</td><td>National Avg.</td><td>OIT ME (8)</td><td>National Avg.</td></tr>
<tr><td>Mathematics</td><td>74%</td><td>75%</td><td>51%</td><td>65%</td><td>62%</td><td>74%</td></tr>
<tr><td>Prob. & Statistics</td><td>79%</td><td>68%</td><td>52%</td><td>63%</td><td>50%</td><td>64%</td></tr>
<tr><td>Chemistry</td><td>73%</td><td>71%</td><td>74%</td><td>78%</td><td>57%</td><td>66%</td></tr>
<tr><td>Computers</td><td>83%</td><td>85%</td><td>75%</td><td>78%</td><td>70%</td><td>77%</td></tr>
<tr><td>Ethics & Bus.</td><td></td><td></td><td>80%</td><td>77%</td><td>81%</td><td>75%</td></tr>
<tr><td>Statics</td><td rowspan="2">87%</td><td rowspan="2">73%</td><td>81%</td><td>81%</td><td>56%</td><td>60%</td></tr>
<tr><td>Dynamics</td><td>70%</td><td>78%</td><td>68%</td><td>74%</td></tr>
<tr><td>Strength of Materials</td><td>75%</td><td>65%</td><td>59%</td><td>60%</td><td>48%</td><td>60%</td></tr>
<tr><td>Material Properties</td><td>71%</td><td>77%</td><td>68%</td><td>68%</td><td>63%</td><td>62%</td></tr>
<tr><td>Fluid Mechanics</td><td>75%</td><td>73%</td><td>70%</td><td>72%</td><td>44%</td><td>60%</td></tr>
<tr><td>Electricity & Mag.</td><td>76%</td><td>69%</td><td>59%</td><td>59%</td><td>49%</td><td>58%</td></tr>
<tr><td>Thermodynamics</td><td>62%</td><td>63%</td><td>38%</td><td>48%</td><td>53%</td><td>56%</td></tr>
</table>

Klamath Falls Assessment, 2014 – 2015 Academic year.
Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 315 Winter term 2015, using an assignment scored with a rubric. This assessment was administered to students from all majors in the MMET Department. There were 36 mechanical engineering students involved in the assessment; the results are shown in Table 4.5.

Note that this assignment did not address the fourth performance criteria, “selects and applies appropriate technology tools”; this performance criteria only applies to our ETAC programs.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Selects & applies math principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	100%
Selects & applies scientific principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	100%
Selects & applies engineering principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	100%
Selects & applies appropriate technology tools	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	N/A

Table 4.5. ME Assessment Results for SLO a, Fall 2014, Klamath Campus

Strengths: The students all scored well in this assessment, noted specifically as: Successful identification of system type; Proper application of relevant scientific/engineering principles.

Weaknesses: Computational Errors; Neglect of Dimensional Units; Disrespect of Significant Figures.

Actions: Reiterate importance of checking all computations, including appropriate units, and expressing correct significant figures.

Klamath Falls Assessment, 2014 – 2015 Academic year.
Direct Assessment #2 Klamath Campus

The faculty assessed this outcome in MECH 316 Machine Design II Fall term 2014, using a project scored with a rubric. This assessment was administered only to mechanical engineering students in the MMET Department. There were 12 mechanical engineering students involved in the assessment; the results are shown in Table 4.6.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Selects & applies math principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	100%
Selects & applies scientific principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	100%
Selects & applies	Rubric-scored	1-4	80% score	83%

engineering principles	exam questions	proficiency scale	3 or 4	
Selects & applies appropriate technology tools	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	100%

Table 4.6. ME Assessment Results for SLO a, Fall 2014, Klamath Campus

Strengths: The results indicate that the students met faculty expectations for all criteria assessed.

Weaknesses: None indicated by the results or instructor feedback.

Actions: None needed at this time, continue assessment as designed.

Klamath Falls Assessment, 2014 – 2015 Academic year.
Direct Assessment #3 Klamath Campus

The faculty assessed this outcome in MECH 480 Winter term 2015, using an assignment scored with a rubric. There were 30 mechanical engineering students involved in the assessment; the results are shown in Table 4.7. Note that this assignment did not address the fourth performance criteria, “selects and applies appropriate technology tools”; this performance criteria only applies to our ETAC programs.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Selects & applies math principles	R`ubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	90%
Selects & applies scientific principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	90%
Selects & applies engineering principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	83%
Selects & applies appropriate technology tools	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	N/A

Table 4.7. ME Assessment Results for SLO a, Fall 2014, Klamath Campus

Strengths: The students all scored well in this assessment; some areas to be noted include: Successful identification of system type; Proper application of relevant scientific/engineering principles.

Weaknesses: Some areas were: Computational Errors; Neglect of Dimensional Units; Disrespect of Significant Figures.

Actions: Reiterate importance of checking all computations, including appropriate units, and expressing correct significant figures.

Seattle Assessment, 2014 – 2015 Academic year.
Direct Assessment #1 Seattle Campus

The faculty assessed this outcome in MECH 316 Machine Design II Winter term 2015, using an assignment scored with a rubric. There were 13 mechanical engineering students who participated in the assessment. The results are shown in Table 4.8.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Selects & applies math principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	84.6%
Selects & applies scientific principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	100%
Selects & applies engineering principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	100%
Selects & applies appropriate technology tools	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	69.2%

Table 4.8. Assessment Results for SLO a, winter 2015, Seattle Campus

Strengths: Most students demonstrated the ability to apply theoretical knowledge gained during their education to real-world problems.

Weaknesses: Some students were overwhelmed and struggled to approach the problem in an engineering manner.

Action: I'm going to include more design project type assignments in the course and curriculum to improve on their abilities.

Seattle Assessment, 2014 – 2015 Academic year.
Direct Assessment #2 Seattle Campus

The faculty assessed this outcome in MECH 313 Thermodynamics II Winter term 2015, using an assignment scored with a rubric. There were 16 mechanical engineering students who participated in the assessment. The results are shown in Table 4.9.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Selects & applies math principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	93.75 %
Selects & applies scientific principles	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	87.5%
Selects & applies	Rubric-scored	1-4	80% score	87.5%

engineering principles	exam questions	proficiency scale	3 or 4	
Selects & applies appropriate technology tools	Rubric-scored exam questions	1-4 proficiency scale	80% score 3 or 4	87.5%

Table 4.9. Assessment Results for SLO a, Winter 2015, Seattle Campus

Strengths: Most students set up the problem correctly and followed the logical steps in solving the problem.

Weaknesses: Some students did not sufficiently label their thermodynamic sketches.

Action: Emphasize the importance of fully annotated sketches and diagrams in problem solving.

Assessment, 2014 – 2015 Academic year.
Indirect Assessment #1 MMET Undergraduate Exit Survey (Both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Student responses over the past three years have been aggregated for this report. There were a total of 30 responses from Klamath Falls seniors and 2 responses from Seattle seniors; for a total of 32 responses. Student responses from all locations indicate that 96.5% of all BSME students felt prepared in this outcome; see Table 4.10 below.

	Highly Prepared	Prepared	Inadequately Prepared
Outcome a	51.7%	44.8%	3.5%

Table 4.10. ME Indirect Assessment for SLO a, Senior Exit Surveys 2014-15

SLO b; an ability to design and conduct experiments, as well as to analyze and interpret data

Klamath Falls Assessment, 2010 – 2011 Academic year.

Assessment method: Direct assessment of student work.

Selected instrumentation intensive lab reports will be reviewed by the faculty member(s) giving the assignment. Reports from Instrumentation (MECH 363), Heat Transfer II (MECH 437) and Vibrations (MECH 480) are assessed. A rubric is used to assess the students' ability to meet the Performance Criteria.

A laboratory relating to temperature was selected from MECH 363. Eleven labs were assessed using the experimentation rubric. Similarly a lumped mass convection laboratory was selected from MECH 437. Ten laboratory reports were assessed using the same rubric. Finally, a lab from MECH 480, forced vibration of a cantilever beam, was assessed. Here ten labs were reviewed and assessed. In each case the percent of students performing at least satisfactorily is reported in Table 4.11.

Table 4.11: Assessment Results for SLO b, Experimentation

Performance Criteria	Minimum Acceptable Performance	MECH 363	MECH 437	MECH 480
Design Experiments	80% score 3 or 4	91%	70%	90%
Execute Experiments	80% score 3 or 4	100%	80%	100%
Understand Experimental Data	80% score 3 or 4	82%	80%	50%

In general the students are adept at designing, executing and analyzing experiments. The experiments in the senior level courses are much less structured which probably gives a better evaluation of their abilities in this area. Also, designing and analyzing experiments are closely tied together. If an experiment is well-designed, the chances of obtaining understandable data increase.

Klamath Falls Assessment, 2010 – 2011 Academic year

Assessment Method: MMET Undergraduate Exit Survey; Indirect Assessment

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2010 nine of the ten students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To design and conduct experiments, as well as to analyze and interpret data."* Table 4.12 shows the results of this inquiry.

Table 4.12: Senior Project Exit Survey, Experimentation

	Highly Prepared	Prepared	Inadequately Prepared
Design and conduct experiments, as well as to analyze and interpret data	89.00%	11.00%	0%

The students feel they are prepared or highly prepared to carry out experiments and interpret the resulting data.

Klamath Falls Assessment, 2013 – 2014 Academic year.
Direct Assessment #1 Klamath Falls Campus

The faculty assessed this outcome in MECH 417 Fluid Mechanics II Winter 2014, using a rubric-graded laboratory assignment. There were 26 mechanical engineering students involved in the assessment. The results are shown in Table 4.13 below.

Table 4.13. Fluid Mechanics II Assessment Results for SLO b, Experimentation

Performance Criteria	Minimum Acceptable Performance	Results
Design an experiment	80% score 3 or 4	88% 23/26
Conduct an experiment	80% score 3 or 4	92% 24/26
Analyze data	80% score 3 or 4	80% 21/26

Strengths: The students showed an overall eagerness to dive in and apply their knowledge.

Weaknesses: None.

Actions: None.

Klamath Falls Assessment, 2013 – 2014 Academic year.
Direct Assessment #2 Klamath Falls Campus

The data for this assignment was collected from MECH 437 Heat Transfer II during the Winter 2012 term, using a rubric-graded laboratory assignment. This data was then assessed during the 2013 – 2014 assessment cycle. There were 21 mechanical engineering students involved in the assessment. The results are shown in Table 4.14 below.

Table 4.14. Heat Transfer II Assessment Results for SLO b, Experimentation

Performance Criteria	Minimum Acceptable Performance	Results
Design an experiment	80% score 3 or 4	86% 18/21
Conduct an experiment	80% score 3 or 4	90% 19/21
Analyze data	80% score 3 or 4	90% 19/21

Strengths: Ability to apply and investigate.

Weaknesses: Some lacking depth of analysis but adequate overall.

Actions: The student work should be collected nearer to the assessment cycle year; this assessment was made using student work from two years ago.

Klamath Falls Assessment, 2013 – 2014 Academic year.
Indirect Assessment #1 MMET Undergraduate Exit Survey

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2014, 20 ME students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To design and conduct experiments, as well as to analyze and interpret data."* Table 4.155 shows the results of this inquiry.

Table 4.15: Senior Project Exit Survey, Experimentation

	Highly Prepared	Prepared	Inadequately Prepared
To design and conduct experiments/analyze data	55.6%	38.9%	5.6%

One student still felt unprepared for experimentation or analysis. Most however felt highly prepared.

Seattle Assessment, 2013 – 2014 Academic year.
Direct Assessment #1 Seattle Campus

The faculty assessed this outcome in MET 160 Materials I Winter 2014, using a rubric-graded laboratory assignment. There were 6 mechanical engineering students involved in the assessment. The results are shown in Table 4.16 below.

Table 4.16. Materials I Assessment Results for SLO b, Experimentation

Performance Criteria	Minimum Acceptable Performance	Results
Conduct an experiment	80% score 3 or 4	100%
Analyze Data	80% score 3 or 4	100%
Use the results to improve a process	80% score 3 or 4	100%

Seattle Assessment, 2013 – 2014 Academic year.
Indirect Assessment #1 MMET Undergraduate Exit Survey

Since the BSME program in Seattle was new this year, there were no students who filled out the survey.

SLO c; an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

Klamath Falls Assessment, 2011 – 2012 Academic year

Assessment Method: Review Project Reports

Project Final Reports were reviewed by the faculty member(s) giving the assignment. Project reports in Orientation and Senior Projects were assessed. An analytic rubric was used in each case to assess the students' ability to meet the Performance Criteria. There was a proficiency scale from 1 to 4 and the "minimum acceptable performance" was determined to be 80% of the students scoring 3 or 4.

Table 4.17 shows the results from project report review in Orientation and Senior Projects. The last assessment, in 2009, assessed project reports in MECH 316, MECH 318 and Senior Projects. These assessments are included for comparison.

Both assessments used final project reports. Faculty overseeing the projects assessed each report using a rubric. All projects included a mix of ME, MET and MFG students. The Orientation class was made up of 38 students with 28 ME students enrolled. However, it is anticipated that some of these freshmen will change majors before graduation.

Assessment results from MECH 492, Senior Projects taught spring term of 2011, are shown. The assignment assessed was the final report developed for this three term sequence. As the project teams are a mix of Mechanical Engineering, Mechanical Engineering Technology and Manufacturing Technology the results are not purely ME related but the information is none the less useful. There were 5 senior projects in 2010-11 and all were assessed.

Table 4.17: Assessment Results for ISLO C

	2009 Assessment			2012 Assessment	
Performance Criteria	MECH 316 (17)	MECH 318 (11)	MECH 492 (8)	MECH 111/112 (28)	MECH 492 (5)
Identify an appropriate set of realistic constraints and performance criteria.	80%	100%	88%	82%	100%
Generate one or more creative solutions.	73%	100%	100%	68%	100%
Create a detailed design within realistic constraints.	40%	73%	100%	79%	100%
Plan and manage a small technical project.	60%	100%	88%	71%	100%

Assessments of the Orientation (MET 111/112) projects were below the desired 80%. However, this seems appropriate for freshmen who have had little or no introduction to engineering projects. It is encouraging to see they improved through their education.

Of the five senior projects none were judged to be unacceptable. Even though assessments were quite high, improvements can always be made.

Klamath Falls Assessment, 2011 – 2012 Academic year.
Assessment Method: MMET Senior Survey Indirect Assessment

As part of the ME capstone course students were asked to complete a senior survey. The process and general results are briefly explained in Outcome (a) above.

For this outcome, "Design a System, Component or Process within Realistic Constraints", 40% felt they were highly prepared and 60% felt prepared. No respondents reported feeling inadequately prepared.

Klamath Falls Assessment, 2014 – 2015 Academic year
Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 316 Machine Design II Fall term 2014, using a design project scored with a rubric. There were 12 mechanical engineering students involved in the assessment. The results are shown in Table 4.18.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify constraints & criteria	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Generate solutions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	58%
Create a design	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Plan and manage a project	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%

Table 4.18. ME Assessment Results for SLO c, Fall 2014, Klamath Campus

Strengths: Students were able to examine different potential failure modes for design of parts.

Weaknesses: Incomplete analysis on part of some students, missing calculation.

Actions: Emphasize all necessary calculations in problem description.

Seattle Assessment, 2014 – 2015 Academic year

Direct Assessment #1 Seattle Campus

The faculty assessed this outcome in MECH 316 Machine Design II Winter term 2015, using an assignment scored with a rubric. There were13 mechanical engineering students involved in the assessment. The results are shown in Table 4.19. Note that the fourth performance criteria "Plan and manage a project" was not assessed. This criteria is not a component of the EAC student outcomes, but is included in the MMET assessments as it applies to the ETAC criteria.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify constraints & criteria	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	76.9%
Generate solutions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	76.9%
Create a design	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	69.2%
Plan and manage a project	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	N/A

Table 4.19. ME Assessment Results for SLO c, Winter 2015, Seattle Campus

Strengths: Most students did a very good job of selecting reasonable components and designing an appropriate shaft.

Weaknesses: Some students struggled to apply the textbook knowledge to real-world problems.

Actions: I'm going to include more design project type problems in my courses.

Assessment, 2014 – 2015 Academic year
_Indirect Assessment #1 MMET Undergraduate Exit Survey (both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Student responses over the past three years have been aggregated for this report. There were a total of 30 responses from Klamath Falls seniors and2 responses from Seattle seniors; for a total of 32 responses. Student responses from all locations indicate that 86.2% of students felt prepared in this outcome. Details are included in Table 4.20 below.

	Highly Prepared	Prepared	Inadequately Prepared
Klamath Falls	31.0%	55.2%	13.8%

Table 4.20. BSME Indirect Assessment for SLO c, Senior Exit Surveys 2014-15

SLO d; an ability to function on multidisciplinary teams

Klamath Falls Assessment, 2012 – 2013 Academic year.
Assessment method: Faculty review of student team experiences

Following the Institution's plan for assessment of this outcome, MMET faculty involved in a group project assessed the group experience. Each faculty advisor assessed group function and dynamics using an analytical rubric. This assessment is done within senior projects. The senior project teams are a mix of the department's three programs, Mechanical Engineering, Mechanical Engineering Technology, and Manufacturing Engineering Technology and in some cases students from outside the department. This gives a good mix of students and an interdisciplinary element to the projects. It also makes assessing Mechanical Engineering students separately difficult.

Table 4.21 shows the aggregate faculty scores. Here the assessment method was a rubric completed by the faculty judging each group with a measurement scale of 1 to 4. Three faculty members were involved in assessing twenty-eight students across seven projects.

Table 4.21. Faculty Assessment Results for SLO d, Teamwork

Performance Criteria	Minimum Acceptable Performance	Results
Achieves Goals/Purpose	80% score 3 or 4	100% 7/7
Assumes Roles and Responsibilities	80% score 3 or 4	86% 6/7
Communicates Effectively	80% score 3 or 4	86% 6/7
Reconciles Disagreements	80% score 3 or 4	86% 6/7
Shares Work Appropriately	80% score 3 or 4	29% 2/7
Develops Strategies/Actions	80% score 3 or 4	29% 2/7
Cultural Adaptation	80% score 3 or 4	86% 6/7

Note: scores are allocated per team. The senior project allows students to experience the intensive pressures of design and building which also leads to disagreements and brings forth teamwork difficulties. Here they may be identified and reconciled. As such, the senior project is imperative to their overall education, especially in teamwork development. The low scores in sharing work and developing strategies/actions reflect the need for this type of education.

Strengths: Focusing on the task and completing the mission

Weaknesses: Ownership of ideas and recognition, some inappropriate interchanges between genders/cultures

Klamath Falls Assessment, 2012 – 2013 Academic year.
Assessment method: Student review of student team experiences

The same rubric as used by faculty above was used by the students to evaluate teamwork. Again this assessment was done within senior projects involving the same teams as the above faculty assessment. Responses were obtained from 28 ME, 4 MET, and 5 MFG students. Students were asked to rate their team's performance. Table 4.22 shows the aggregate student scores, and Table 4.23 shows the mix of students by major.

Table 4.22. Assessment Results for SLO d, Teamwork

Performance Criteria	Minimum Acceptable Performance	ME	MET	MFG	Overall
Achieves Goals/Purpose	80% score 3 or 4	96% 26/27	4/4	5/5	97% 35/36
Assumes Roles and Responsibilities	80% score 3 or 4	81% 22/27	3/4	5/5	83% 30/36
Communicates Effectively	80% score 3 or 4	93% 25/27	2/4	4/5	86% 31/36
Reconciles Disagreements	80% score 3 or 4	75% 21/28	2/4	5/5	76% 28/37
Shares Work Appropriately	80% score 3 or 4	71% 20/28	3/4	4/5	73% 27/37
Develops Strategies/Actions	80% score 3 or 4	82% 23/28	2/4	5/5	81% 30/37
Cultural Adaptation	80% score 3 or 4	93% 26/28	3/4	5/5	92% 34/37

Results: In the academic environment, students want their grade. This leads to desired ownership and a desire to see the best in a project. As a result the students tend to more readily see the advantages their own ideas and want credit for that. It is difficult to have students set aside personal advancement and see what is best for the project. Some gender and cultural difficulties were observed. Project management was weak (last minute scrambling).

Outcome: Instructors are briefed on judging student contributions such that students are clear on objectives and that they will get due credit for their work and contributions more so than whether their idea is actually implemented or not.

Since student self-evaluation reflects the end result of what the students feel they learned, and faculty gave judgments on what they observed during the process, the students may have achieved the desired outcome of better teamwork skills as a result of the poor behavior and its resolution.

Table 4.23. Discipline Mix on Senior Project Teams

Project	ME	MET	MFG
Knee	4		
Grappler	3		1
BHS	4		3
Eco-Marathon	10	1	
SAE Formula	7	3	1

Klamath Falls Assessment, 2012 – 2013 Academic year.

Assessment Method: MMET Undergraduate Exit Survey Indirect Assessment

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2013, 17 students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To function on multi-disciplinary teams."* Table 4.24 shows the results of this inquiry.

Table 4.24: Senior Project Exit Survey, Teamwork

	Highly Prepared	**Prepared**	**Inadequately Prepared**
To function on multi-disciplinary teams	9	8	0

The students feel they are prepared or highly prepared for teamwork. Despite some disagreements during senior projects, all felt they were prepared to work in a team environment. Perhaps living through the difficulty helped to prepare them.

SLO e; an ability to identify, formulate, and solve engineering problems

Klamath Falls Assessment, 2011 – 2012 Academic year

Assessment Method: Review Lab Reports

Selected Lab Reports were reviewed by the faculty member(s) giving the assignment. Reports from Finite Element Analysis (MECH 351), Fluid Mechanics II (MECH 417), Heat Transfer II (MECH 437) and Vibrations (MECH 480) were assessed. The number of students in each assessment is listed in parentheses under the course number. An analytic rubric was used to assess the students' ability to meet the Performance Criteria. The rubric had a measurements scale of 1 to 4. The data indicates the percentage of students performing at a level of 3 or 4, proficient or highly proficient.

Results from the last assessment, in 2009, are included for comparison. MECH 351 was not assessed in 2009.

4.25 shows the results of this assessment.

Table 4.25: Assessment for SLO E

	2009 Assessment			2012 Assessment			
Performance Criteria	MECH 417 (17)	MECH 437 (11)	MECH 480 (17)	MECH 351 (11)	MECH 417 (7)	MECH 437 (20)	MECH 480 (24)
Identify an Engineering Problem	100%	100%	100%	100%	100%	100%	92%
Make appropriate assumptions	100%	100%	94%	100%	100%	80%	88%
Formulate a plan which will lead to a solution	100%	100%	88%	100%	100%	95%	83%
Apply engineering principles to analyze the problem	N/A	100%	94%	91%	100%	90%	79%
Document results in an appropriate format	100%	72%	100%	100%	100%	95%	83%

Students are meeting, or nearly meeting, our desired 80% proficient or highly proficient criteria. The results are very similar to the last assessment evaluations done in 2009.

Klamath Falls Assessment, 2011 – 2012 Academic year

Assessment Method: MMET Undergraduate Exit Survey Indirect Assessment

As part of the ME capstone course students were asked to complete a senior survey. The process and general results are briefly explained in Outcome (a) above.

For this outcome, "Identify, Formulate and Solve Engineering Problem," 60% felt they were highly prepared and 40% felt prepared. No respondents reported feeling inadequately prepared.

Klamath Falls Assessment, 2014 – 2015 Academic year
Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 437 Heat Transfer II Winter term 2015, using a lab report scored with a rubric. There were 32 mechanical engineering students involved in the assessment. The results are shown in Table 4.26.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify an engineering problem	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	96.7%
Analysis & assumptions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Formulate a plan	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Apply engineering principles	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Document results	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	93.3%

Table 4.26. ME Assessment Results for SLO e, Winter 2015, Klamath Campus

Strengths: Students have relatively good analytical and report writing skills.

Weaknesses: none.

Actions: none.

Klamath Falls Assessment, 2014 – 2015 Academic year
Direct Assessment #2 Klamath Campus

The faculty assessed this outcome in MECH 351 Finite Element Analysis Fall term 2014, using a lab report scored with a rubric. There were 19 mechanical engineering students involved in the assessment. The results are shown in Table 4.27.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify an engineering problem	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Analysis & assumptions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	84.2%
Formulate a plan	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	94.7%
Apply engineering principles	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	84.2%

Document results	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	94.7%

Table 4.27. ME Assessment Results for SLO e, Fall 2015, Klamath Campus

Strengths: Good understanding of FEA procedure; Identifying the problem and formulating the plan to solve the problem.

Weaknesses: Setting the appropriate constraints (creating a new coordinate system for the second support) when using Creo Simulate; Computational errors; Neglect of dimensional units. .

Actions: Emphasize the importance of dimensional units; Spend more time practicing on how to apply appropriate constraints and external moment when performing FEA using Creo Simulate.

Seattle Assessment, 2014 – 2015 Academic year
Direct Assessment #1 Seattle Campus

The faculty assessed this outcome in MECH 437 Heat Transfer II Summer term 2015, using an assignment scored with a rubric. There were10 mechanical engineering students involved in the assessment. The results are shown in Table 4.28.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify an engineering problem	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Analysis & assumptions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	80%
Formulate a plan	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Apply engineering principles	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Document results	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	90%

Table 4.28. ME Assessment Results for SLO e, Summer 2015, Seattle Campus

Strengths: The students scored at or above the minimum acceptable performance score.

Weaknesses: None identified.

Actions: None.

Assessment, 2014 – 2015 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey (both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Student responses over the past three years have been aggregated for this report. There were a total of 30 responses from Klamath Falls seniors and 2 responses from Seattle seniors; for a total of 32 responses. Student responses from all locations indicate that 96.5% of students felt prepared in this outcome. Details are included in Table 4.29.

	Highly Prepared	Prepared	Inadequately Prepared
Klamath Falls	51.7%	44.8%	3.5%

Table 4.29. ME Indirect Assessment for SLO e, Senior Exit Surveys 2014-15

SLO f; an understanding of professional and ethical responsibility

Klamath Falls Assessment, 2012 – 2013 Academic year

Assessment method: Direct assessment of student work.

Paralleling the institution's assessment of ethics, the ME program uses an institutional rubric created at Oregon Tech. The faculty assessed an upper-division assignment addressing the ASME code of ethics and an ethical scenario. A short paper assigned in senior projects is used. The results of this assessment are shown in Table 4.30.

Table 4.30. Assessment Results for SLO f, fall term 2012, Senior Projects, 10 seniors

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Knowledge of code of ethics	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100% 10/10
Describes ethical issue(s)	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100% 10/10
Describes parties involved and discusses their points of view	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100% 10/10
Describes and analyzes possible/ alternative approaches	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100% 10/10
Chooses an approach and explains the benefits and risks	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	90% 9/10

The ethics assignment asked students questions about the ASME Canons and then gave an ethics scenario to be evaluated. Students were asked to describe the parties involved, describe alternatives, and choose a particular approach related to the ethics scenario presented. Each of these were assessed using the institutional ethics rubric.

For this performance assessment the department set a goal to have over 80% of students performing at a rubric level of 3 or 4, proficient or highly proficient. As seen in Table 6 students performed above this level related to all institutional performance criteria.

Students reviewed by this assessment are performing above expectations. They have a good academic knowledge related to ethical issues. These institutional performance criteria relate to the ME Program's first two performance criteria listed above and show students within the program are meeting this portion of the SLO.

Klamath Falls Assessment, 2012 – 2013 Academic year

Assessment Method: Faculty Assessment of Student Actions

To assess professionalism the Program Directors of the ME, MET and MFG programs came together to assess each graduating seniors conduct. Twelve areas were evaluated on a scale of 0 to 2. The desire was for at least 80% of the students to attain an evaluation of one or two. Table 4.31 shows the result of this activity for the sixteen ME students expected to graduate in spring term 2013.

The assessment shows the faculty feel the ME students exhibit professionalism in the areas considered.

Table 4.31. Faculty Professionalism Assessment

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Timeliness of work	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Quality of work (course expectations)	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Quality of work (work product)	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Attitude toward feedback	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Attitude toward assigned tasks	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Punctuality	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Attendance	Faculty Rating	0-2 scale	80% at 1 or 2	15/16
Academic Integrity	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Interpersonal skills	Faculty Rating	0-2 scale	80% at 1 or 2	15/16
Knowledge of classroom policies and procedures	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Work ethic	Faculty Rating	0-2 scale	80% at 1 or 2	16/16
Appearance	Faculty Rating	0-2 scale	80% at 1 or 2	16/16

Result: Only 4 of the 16 students received less than a majority of perfect “2” scores. The year, 2012-2013 seemed to have a professional group. (Except for some teamwork issues addressed above).

Klamath Falls Assessment, 2012 – 2013 Academic year

Assessment Method: MMET Undergraduate Exit Survey Indirect Assessment

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2013, 17 students in senior projects completed an exit survey. Students were asked to

"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have an understanding of professional and ethical responsibility". Table 4.32 shows the results of this inquiry.

Table 4.32: Senior Project Exit Survey, Professional Responsibilities & Ethics

	Highly Prepared	**Prepared**	**Inadequately Prepared**
To have an understanding of professional and ethical responsibility	5	12	0

The students feel they are prepared or highly prepared for teamwork. Students remain apprehensive about the details of various employment possibilities they may encounter.

SLO g; an ability to communicate effectively

Klamath Falls Assessment, 2010 – 2011 Academic year
Assessment method: Direct assessment of student oral presentation

Paralleling the institution's assessment, the ME program used the performance criteria (listed above) and an institutional rubric created by OIT. In the ME program, faculty assess individual student presentations in MECH 360 Materials I.

In winter term 2010, 24 students gave presentations and were assessed in MECH 360. Table 4.33 shows the results of this assessment. Student presentations were judged to be more than adequate in all areas.

Assessment Method: Direct assessment of student written report

Paralleling the institution's assessment, the ME program used the performance criteria (listed above) and an institutional rubric created by OIT. In the ME program, faculty assessed an individual student paper from a senior level class.

For the 2010-11 assessment a paper assigned in ENGR 485 was collected. This assignment was used for assessing written communication as well as lifelong learning. Scores from rubric evaluation of this assignment are shown in Table 4.34. Ten ME students are represented in this data.

Table 4.33: Oral Presentation Assessment

Performance Criteria	Minimum Acceptable Performance	ENGR 485
Content	80% score 3 or 4	100%
Organization	80% score 3 or 4	100%
Style	80% score 3 or 4	96%
Delivery	80% score 3 or 4	88%

Visuals	80% score 3 or 4	100%

As seen in Table 4.34 the students performed well. The only area which could be considered weak is in organization. The evaluator felt these papers were all done quickly with little hard research. He felt the effort put forth by the students was less than that shown on most technical papers prepared by the same students. The paper was given weight in course grading, however the course is only one credit and has a pass-fail grading structure. This may account for the low priority the students apparently applied to this assignment.

Table 4.34: Assessment of Written Assignment

Performance Criteria	Minimum Acceptable Performance	ENGR 485
Purpose and Ideas	80% score 3 or 4	90%
Organization	80% score 3 or 4	70%
Support	80% score 3 or 4	80%
Style	80% score 3 or 4	90%
Conventions	80% score 3 or 4	80%
Documentation	80% score 3 or 4	100%

Considering the shortcomings of the assessed assignment, the results are encouraging.

Klamath Falls Assessment, 2010 – 2011 Academic year

Assessment Method: MMET Undergraduate Exit Survey (Indirect Assessment)

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2010 nine of the ten students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have the ability to communicate effectively."* Table 4.35 shows the results of this inquiry.

Table 4.35: Senior Project Exit Survey, Communication

	Highly Prepared	Prepared	Inadequately Prepared
Have the ability to communicate effectively	78%	22%	0%

The students feel they are prepared or highly prepared to communicate effectively.

Klamath Falls Assessment, 2013 – 2014 Academic year
Direct Assessment #1 Klamath Falls Campus

The faculty assessed the written portion of this outcome in Senior Projects II Winter 2014, using a rubric-graded student paper on life-long learning, and combined results from two sections: Professor Moravec and Professor Stuart. There were 10 mechanical engineering students involved in the assessment. The results are shown in Table 4.36 below.

Table 4.36 Senior Project II Assessment Results for SLO g, Written Communication

Performance Criteria	Minimum Acceptable Performance	Results
Purpose and Ideas	80% score 3 or 4	100%
Organization	80% score 3 or 4	100%
Support	80% score 3 or 4	100%
Style	80% score 3 or 4	100%
Conventions	80% score 3 or 4	100%
Documentation	80% score 3 or 4	40%

The students scored well in all areas of this assessment except for Documentation. More emphasis on proper documentation should be given by the faculty.

Klamath Falls Assessment, 2013 – 2014 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey

In spring of 2014, 20 ME students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have the ability to communicate effectively."* Table 4.37 shows the results of this inquiry.

Table 4.37: Senior Project Exit Survey, Communication

	Highly Prepared	Prepared	Inadequately Prepared
To have the ability to communicate effectively	77.8%	11.1%	11.1%

Most students feel highly prepared – although 2 felt the opposite. The students' confidence seems to come out in their presentations. The Industry Advisory Council however continues to emphasize a desire to improve communication skills in graduates. It is unclear if they are speaking of students from all colleges or ours specifically. This questions needs to be addressed to the council more directly.

Seattle Campus Assessment:

At the Seattle campus the oral portion of this outcome was directly assessed in one course, Senior Project I; no written assessment was done.

Seattle Assessment, 2013 – 2014 Academic year
Direct Assessment #1 Seattle Campus

The faculty assessed the oral portion of this outcome in Senior Projects I Fall 2013, using a rubric-graded presentation. There were 6 mechanical engineering students involved in the assessment. The results are shown in Table 4.38 below.

Table 4.38 Senior Project I Assessment Results for SLO g, Oral Communication

Performance Criteria	Minimum Acceptable Performance	Results
Content	80% score 3 or 4	100%
Organization	80% score 3 or 4	100%
Style	80% score 3 or 4	83%
Delivery	80% score 3 or 4	100%
Visuals	80% score 3 or 4	100%

The students scored well in all areas of this assessment.

Seattle Assessment, 2013 – 2014 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey

Since the BSME program in Seattle was new this year, there were no students who filled out the survey.

SLO h; the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

Klamth Falls Assessment, 2012 – 2013 Academic year

Assessment method: Direct assessment of student work.

Towards the end of the student's experience, within Senior Projects, an assignment is given to allow assessment of this SLO. A short paper is required giving the student an opportunity to analyze a topic or situation involving these performance criteria. A rubric developed by the departmental faculty was used to assess this assignment.

An assignment was given in senior projects winter term 2013. This asked the students to assess the reality and effects of portable energy. The rubric presented in Appendix II was applied by the faculty members involved in this course sequence. Table 4.39 presents the results of this assessment for mechanical engineering students.

Table 4.39. Assessment Results for SLO h, winter term 2013, Senior Projects, 13 seniors

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Understand global impact of engineering decisions	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100% 13/13
Understand macro-economic impact of engineering solutions	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100% 13/13
Understand environmental and social impact of engineering decisions	Rubric-graded assignment	1-4 proficiency scale	80% score 3 or 4	100% 13/13

The assessment shows good performance in all categories.

Klamth Falls Assessment, 2012 – 2013 Academic year

Assessment Method: MMET Undergraduate Exit Survey Indirect Assessment

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2013, 17 students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context."* Table 4.40 shows the results of this inquiry.

Table 4.40 : Senior Project Exit Survey, Broad Education

	Highly Prepared	Prepared	Inadequately Prepared
To have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context	5	12	0

In general the students feel they are prepared or highly prepared for engineering impacts and globalization. Potential reluctance may still exist because they know they will be working in a world market, but there are so many, and they don't know details about them all.

SLO i; a recognition of the need for, and an ability to engage in life-long learning

Klamath Falls Assessment, 2010 – 2011 Academic year
Assessment Method: Direct assessment of student work

Paralleling the institution's assessment, the ME program used the performance criteria (listed above) and a institutional rubric created by OIT. Assessment within the ME program involved an individual student paper from ENGR 485 Fundamentals of Engineering Exam. For this assessment cycle the papers to be used were collected spring term 2010.

Results from this assessment are shown in Table 4.41. This represents papers from 10 students.

Table 4.41: Assessment of Lifelong Learning Paper

Performance Criteria	Minimum Acceptable Performance	ENGR 485
Lifelong Learning	80% score 3 or 4	70%
Professional Societies	80% score 3 or 4	70%
Credentials	80% score 3 or 4	80%
Continuing Education	80% score 3 or 4	80%
Career Paths	80% score 3 or 4	90%

The assessment results fell short of that desired in two areas. It was hoped the students would have a better understanding of lifelong learning possibilities and the details of professional society membership. This may be in part due to the nature of the paper assessed. The evaluator felt less effort was put forth on this paper than on most technical papers prepared by the same students. Although this paper counted towards grades, it is for a one credit pass-fail course. It was hoped the students would do more research into the topic than they obviously did.

Klamath Falls Assessment, 2010 – 2011 Academic year
Assessment Method: MMET Undergraduate Exit Survey Indirect Assessment

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2010 nine of the ten students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To recognize the need for, and have the ability to engage in life-long learning"*. Table 4.42 shows the results of this inquiry.

Table 4.42: Senior Project Exit Survey, Lifelong Learning

	Highly Prepared	Prepared	Inadequately Prepared
Recognize the need for, and have the ability to engage in life-long learning	67%	33%	0%

The students feel they are prepared or highly prepared for lifelong learning.

Klamath Falls Assessment, 2013 – 2014 Academic year
Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 491 Senior Project II, winter 2014, using a rubric-graded written assignment. There were 10 BSME students involved in the assessment. The results are shown in Table 4.43 below.

Table 4.43. Lifelong learning assessment Klamath Falls

Performance Criteria	Minimum Acceptable Performance	Results
Lifelong learning	80% at 3 or 4	100%
Professional Development	80% at 3 or 4	100%
Short and long term career plans	80% at 3 or 4	100%

The students scored well in all areas of this assessment.

Klamath Falls Assessment, 2013 – 2014 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey

Of 20 graduates canvassed, 3 plan to continue their education – all with OIT. Also, when asked how well they, "recognize the need for, and have the ability to engage in life-long learning." They responded as follows in Table 4.44:

Table 4.44. Survey Results for SLO i, Lifelong learning, spring term 2014, Senior Projects,

Performance Criteria	Highly prepared	Prepared	Inadequately prepared
Lifelong learning	55.6%	38.9%	5.6%

All except for one student felt prepared or highly prepared.

Seattle Assessment, 2013 – 2014 Academic year
Direct Assessment #1 Seattle Campus

The faculty assessed this outcome in MECH 490 Senior Project I, fall 20143, using a rubric-graded written assignment. There were 6 BSME students involved in the assessment. The results are shown in Table 4.45 below.

Table 4.45. Lifelong learning assessment Seattle

Performance Criteria	Minimum Acceptable Performance	%
Lifelong learning	80% at 3 or 4	83%
Professional Development	80% at 3 or 4	100%
Short and long term career plans	80% at 3 or 4	100%

The students scored well in all areas of this assessment.

Seattle Assessment, 2013 – 2014 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey

Since the BSME program in Seattle was new this year, there were no students who filled out the survey.

SLO j; a knowledge of contemporary issues

Klamath Falls Assessment, 2010 – 2011 Academic year
Assessment method: Direct assessment of student work

The program assesses student knowledge of contemporary issues through a structured discussion with the students in senior projects. A series of questions relating to contemporary issues was prepared but not made available to the students before the discussion period. The list of questions is shown below in Table 4.46. During the discussion each student was asked to address a question of their choice. After each student had participated the discussion was opened up for any student to address other questions.

Table 4.46 Contemporary Issues Questions for Discussion

1. Should the USA and its allies have invaded Afghanistan?
2. Should African disputes and conflicts be handled by African countries themselves, rather than by external international organizations?
3. Should assisted suicide be legal?

4. Should the government bailout banks and financial institutions?
5. Are biofuels a better alternative to fossil fuels? Should their use be encouraged by government regulations and subsidy?
6. Does China give the rest of the world reasons for fear, in political, economic or social terms? Or is the 'Terror from the East' merely a myth?
7. Should the United States promote democracy internationally? Can, and should, democracy be imposed on countries?
8. Has the rise and spread of trans-national companies exacerbated global economic inequalities?
9. Should the United States introduce a universal health care system?
10. Should the United States do more to prevent illegal immigration and seek to identify and expel illegal aliens? Or should it pursue immigration reform, for example by granting an amnesty for existing illegal immigrants, and offering legal guest worker programs?
11. Should governments censor material on the world wide web?
12. Does the Islamic Republic of Iran have the right to develop nuclear weapons, or are the USA and its allies justified in placing sanctions on Iran as a result of suspicions about its nuclear program?
13. Should the USA and its allies withdraw their forces from Iraq immediately?
14. Should Microsoft be broken up into two or more separate companies?
15. Should the United States allow more drilling for oil in inshore coastal waters?
16. Are security measures justified to the extent that civil liberties can be sacrificed?

The discussion included MET and MFG technology students as well as ME students. Twelve ME students participated. The senior project faculty assessed the responses from each participating student. The faculty used the rubric supplied, but were otherwise free to use their judgment. Results from this assessment are shown in Table 4.47.

Table 4.47: Results from Contemporary Issues Discussion

Faculty Member	Accepted Performance	Contemporary Knowledge Discussion
Hugh Currin	80% score 3 or 4	67%
Brian Moravec	80% score 3 or 4	17%
Joe Stuart	80% score 3 or 4	58%
David Culler	80% score 3 or 4	75%

The discussions were enlightening and gave some insight into student knowledge outside the field of engineering. However, the evaluations from faculty varied widely. Review of the assessment showed the low evaluations and large discrepancies came from the assessment tool and its application. The students were simply asked to comment on a question of their choice. They, understandably, gave their opinions with some justification. The rubric however asked for compairsons and the ability to understand varying viewpoints. The rubric also is to assess both major socio-economic and U.S. political issues. It was suggested that the directions to the students be changed requiring them to give varying viewpoints, not just one side of an issue. Also, the scope of the requested response should be more clearly defined.

Assessment Method: MMET Undergraduate Exit Survey

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2010 nine of the ten students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have knowledge of contemporary issues."* Table 4.48 shows the results of this inquiry.

Table 4.48: Senior Project Exit Survey, Contemporary Issues

	Highly Prepared	Prepared	Inadequately Prepared
Have knowledge of contemporary issues	44%	56%	0%

The students feel they are prepared or highly prepared with knowledge of contemporary issues.

Klamath Falls Assessment, 2013 – 2014 Academic year
Assessment method: Direct assessment of student work

No direct assessment for this outcome was completed at either campus. This outcome needs to be directly addressed at both campuses before our next ABET visit.

Klamath Falls Assessment, 2010 – 2011 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey

In spring of 2014, 20 ME students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have knowledge of contemporary issues."* Table 4.49 shows the results of this inquiry.

Table 4.49 : Senior Project Exit Survey, Contemporary Issues

	Highly Prepared	Prepared	Inadequately Prepared
To have knowledge of Contemporary Issues	44.4%	44.4%	11.1%

The majority of the students felt that they were either Prepared or Highly Prepared.

SLO k: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Klamath Falls Assessment, 2010 – 2011 Academic year
Assessment method: Direct assessment of student work

The courses in which assessment was done include Finite Element Analysis (MECH 351), Heat Transfer II (MECH 437) and Senior Projects. These should give a good sampling to assess the performance criteria above. An analytic rubric was applied to select student work and reviewed by the faculty. Assessment in MECH 351 and MECH 437 asked the faculty member teaching the particular course to evaluate a lab assignment using the rubric. Assessments were obtained from 5 students in MECH 351 and 10 students in MECH 437. In senior projects the involved faculty were asked to assess each ME student through observation of their performance on the project. In senior projects 10 students were assessed. Table 4.50 shows the results of these evaluations. They represent the percent of students performing at or above a satisfactory level.

Table 4.50: Assessment Results for SLO K, Engineering Tools

Performance Criteria	Minimum Acceptable Performance	MECH 351	MECH 437	Senior Projects
Computer Use	80% score 3 or 4	40%	100%	90%
CAD Use	80% score 3 or 4	60%	N/A	100%
Design for Manufacturability	80% score 3 or 4	N/A	N/A	100%

As seen in Table 4.50 the results are somewhat scattered. Evaluations made in MECH 351 shows performance below what we'd like to see, while assessments in senior projects are very good. This scatter, and several assessments finding the assignment used to be “not applicable,” point to weaknesses in the assessment scheme.

Klamath Falls Assessment, 2010 – 2011 Academic year
Assessment Method: MMET Undergraduate Exit Survey Indirect Assessment

During the spring term each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO.

In spring of 2010 nine of the ten students in senior projects completed an exit survey. Students were asked to *“Please rate how well the Mechanical Engineering Program prepared you in the following areas: To use the techniques, skills, and modern engineering tools necessary for engineering practice.”* Table 4.51 shows the results of this inquiry.

Table 4.51: Senior Project Exit Survey, Engineering Tools

	Highly Prepared	Prepared	Inadequately Prepared
Use the techniques, skills, and modern engineering tools necessary for engineering practice	56%	44%	0%

The students feel they are prepared or highly prepared to use modern engineering tools.

Klamath Falls Assessment, 2013 – 2014 Academic year
Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MET 375 Solid Modeling fall term 2013, using an assignment scored with a rubric. There were 10 BSME students involved in the assessment. The results are shown in Table 4.52 below.

Table 4.52. Assessment Results for SLO k, Fall 2013 Klamath Falls

Performance Criteria	Minimum Acceptable Performance	Results
Use computers and a wide range of programs effectively	80% score 3 or 4	100%
Appropriate mastery of modern engineering tools.	80% score 3 or 4	100%
Use the techniques and skills necessary for engineering practice.	80% score 3 or 4	70%

Strengths: Students are beginning to see the 3D model as more than a single file and can be revised in the future which a useful understanding in the industry.

Weaknesses: Students need to include more detail in their solid models.

Action: Redesign the assignment with more specific instructions and require review of the material as the student develops the work.

Klamath Falls Assessment, 2013 – 2014 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey

In spring of 2014, 20 ME students in senior projects completed an exit survey. Students were asked to *"Please rate how well the Mechanical Engineering Program prepared you in the following areas: To have knowledge of contemporary issues."* Table 4.53 shows the results of this inquiry.

Table 4.53 Survey Results for SLO K, Modern Tools

Performance Criteria	Highly prepared	Prepared	Inadequately prepared
Modern Tools	61.1%	38.9%	0.0%

All of the students participating in the survey felt that they were either Prepared or Highly Prepared to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Seattle Assessment, 2013 – 2014 Academic year
Direct Assessment #1 Seattle Campus

The faculty assessed this outcome in MECH 351 Finite Element Analysis Spring term 2014, using an assignment scored with a rubric. There were 7 BSME students involved in the assessment. The results are shown in Table 4.54 below.

Table 4.54. Assessment Results for SLO k, Spring 2014 Seattle

Performance Criteria	Minimum Acceptable Performance	Results
Use computers and a wide range of programs effectively	80% score 3 or 4	86%
Appropriate mastery of modern engineering tools.	80% score 3 or 4	86%
Use the techniques and skills necessary for engineering practice.	80% score 3 or 4	86%

Strengths that were demonstrated by the students in this exercise: In general the students were very competent with using CAD and FEA tools.

Weaknesses that were demonstrated by the students in this exercise: Some students still have difficulty understanding the problem constraints. Several students also struggled with understanding how to properly apply boundary conditions.

Proposed actions to improve the assessment or students' performance: Improve the problem statement to better describe the constraints; and place additional emphasis on how to determine reasonable boundary conditions.

Seattle Assessment, 2013 – 2014 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey

Since the BSME program in Seattle was new this year, there were no students who filled out the survey.

SLO m1; Graduates will be able to identify, formulate and solve thermal systems problems.

Klamath Falls Assessment, 2011 – 2012 Academic year.
Assessment Method: Review Lab Reports

Selected Lab Reports were reviewed by the faculty member(s) assigning those labs. Reports from Fluid Mechanics II (417 MECH) and Heat Transfer II (MECH 437) were assessed. An analytic rubric was used to assess the students' ability to meet these Performance Criteria. This was the same rubric and scoring used in SLO E above. The number of students involved in each is given in parenthesis below the course number.

Table 4.55 shows the results from this assessment. Results from the last assessment, in 2009, are included for reference.

Table 4.55: Assessment Results for SLO me1

	2009 Assessment			2012 Assessment	
Performance Criteria	MECH 417 (17)	MECH 437 (11)		MECH 417 (7)	MECH 437 (20)
Identify an Engineering Problem	100%	100%		100%	100%
Make appropriate assumptions	100%	100%		100%	80%
Formulate a plan which will lead to a solution	100%	100%		100%	95%
Apply engineering principles to analyze the problem	N/A	100%		100%	90%
Document results in an appropriate format	100%	72%		100%	95%

Students are easily meeting our desired 80% proficient or highly proficient criteria.

Klamath Falls Assessment, 2011 – 2012 Academic year.
Assessment Method: Fundamentals of Engineering Exam

The Fundamentals of Engineering Exam is taken by all ME students the term before graduation. The results from the spring 2012 exam will not be known until summer 2012. Thus results from the prior year's exam, spring 2011, is used here.

Results from the FE Exam are broken down into disciplines. Those relevant to thermal sciences are tabulated in 4.56. Three students took the exam in 2008 and eight in 2011.

Table 4.56: FE Exam Results from spring 2011

	2008 Results		***2011 Results***

Discipline	***OIT ME (3)***	***National Avg.***		***OIT ME (8)***	***National Avg.***
Thermo. & Energy Conversion	44%	44%		42%	61%
Fluid Mechanics & Fluid Machinery	52%	58%		47%	62%
Heat Transfer	67%	47%		65%	71%
Refrigeration & HVAC	56%	48%		31%	54%

FE Exam results in thermal sciences are, in general, slightly below the national average. Falling below the national average is of concern but may be due to the program's requirement that all students sit for the exam. Another concern is the low number of students sitting for the exam.

Klamath Falls Assessment, 2011 – 2012 Academic year.
Assessment Method: MMET Senior Survey Indirect Assessment

As part of the ME capstone course students were asked to complete a senior survey. The process and general results are briefly explained in Outcome (a) above.

For this outcome, “thermal systems”, 50% felt they were highly prepared and 50% felt prepared. None of the reporting students feeling inadequately prepared.

Klamath Falls Assessment, 2014 – 2015 Academic year.
Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 437 Heat Transfer II Winter term 2015, using a design project scored with a rubric. There were 30 mechanical engineering students involved in the assessment. The results are shown in Table 4.57.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify an engineering problem	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	73%
Analysis & assumptions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	63%
Formulate a plan	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	60%
Apply engineering principles	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	97%
Document results	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	97%

Table 4.57. ME Assessment Results for SLO ME1, Winter 2015, Klamath Campus

Strengths: Students have relatively good analytical and report writing skills.

Weaknesses: Students had difficulty identifying the problem, making assumptions and formulating a plan to solve the problem.

Actions: Spend more time emphasizing the importance of problem identification, assumptions and formulating a plan to solve the problem.

Seattle Assessment, 2014 – 2015 Academic year.
Direct Assessment #1 Seattle Campus

The faculty assessed this outcome in MECH 437 Heat Transfer II Summer term 2015, using an assignment scored with a rubric. There were 10 mechanical engineering students involved in the assessment. The results are shown in Table 4.58.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify an engineering problem	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Analysis & assumptions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	80%
Formulate a plan	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Apply engineering principles	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Document results	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	90%

Table 4.58. ME Assessment Results for SLO ME1, Summer 2015, Seattle Campus

Strengths: The students scored at or above the minimum acceptable performance score

Weaknesses: None identified.

Actions: None.

Seattle Assessment, 2014 – 2015 Academic year.
Direct Assessment #2 Seattle Campus

The faculty assessed this outcome in MECH 323 heat Transfer I Spring term 2015, using an assignment scored with a rubric. There were 19 mechanical engineering students involved in the assessment. The results are shown in Table 4.59.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify an engineering problem	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	78.9%

Analysis & assumptions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	94.7%
Formulate a plan	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	89.5%
Apply engineering principles	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	89.5%
Document results	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	89.5%

Table 4.59. ME Assessment Results for SLO ME1, Spring 2015, Seattle Campus

Strengths: Students tackled the problem different ways and generally solved the problem correctly.

Weaknesses: Students did not include all of the important information in defining the problem.

Actions: This part of clearly identifying the engineering problem will be stressed in the future.

Assessment, 2014 – 2015 Academic year.
Indirect Assessment #1 MMET Undergraduate Exit Survey (both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Student responses over the past three years have been aggregated for this report. There were a total of 30 responses from Klamath Falls seniors and 2 responses from Seattle seniors; for a total of 32 responses. Student responses from all locations indicate that 86.2% of students felt prepared in this outcome. Details are included in Table 4.60.

	Highly Prepared	Prepared	Inadequately Prepared
Klamath Falls	17.2%	69.0%	13.8%

Table 4.60. ME Indirect Assessment for SLO ME1, Senior Exit Surveys 2014-15

SLO m2; Graduates will be able to identify, formulate and solve mechanical systems problems

Klamath Falls Assessment, 2011 – 2012 Academic year.
Assessment Method: Review Lab Reports

Selected Lab Reports were reviewed by the faculty member(s) assigning those labs. Lab reports from Finite Element Analysis and Vibrations were assessed. An analytic rubric was used to assess the students' ability to meet the Performance Criteria. This was the same rubric used in SLO E above. The number of students is listed in parenthesis below the course number. Results from the last assessment, in 2009, is included for comparison. Note that MECH 351 was not assessed in 2009.

4.61 shows the results for this assessment.

Table 4.61: Assessment Results from SLO me2

	2009 Assessment		2012 Assessment

Performance Criteria	MECH 480 (17)		MECH 351 (11)	MECH 480 (24)
Identify an Engineering Problem	100%		100%	92%
Make appropriate assumptions	94%		100%	88%
Formulate a plan which will lead to a solution	88%		100%	83%
Apply engineering principles to analyze the problem	94%		91%	79%
Document results in an appropriate format	100%		100%	83%

Students are meeting, or nearly meeting, our desired 80% proficient or highly proficient criteria. The results are in line with the last assessment evaluations done in 2009.

Klamath Falls Assessment, 2011 – 2012 Academic year
Assessment Method: Fundamentals of Engineering Exam

The Fundamentals of Engineering Exam is taken by all ME students the term before graduation. The results from the spring 2012 exam will not be known until summer 2012. In 2008 three students sat for the exam while in 2011 eight did.

Results from the FE Exam are broken down into disciplines. Those relevant to mechanical systems are tabulated in Table 4.62.

Table 4.62: FE Exam Mechanical System Results

	2008 Results			***2011 Results***	
Discipline	***OIT ME (3)***	***National Avg.***		***OIT ME (8)***	***National Avg.***
Mechanical Design & Analysis	30%	35%		62%	71%
Kinematics, Dynamics & Vibrations	85%	68%		58%	61%
Materials & Processing	72%	46%		60%	69%
Measurement, Instrumentation & Controls	56%	46%		40%	57%

FE Exam results in mechanical systems are, in general, slightly below the national average. Falling below the national average is of concern but may be due to the program's requirement that all students sit for the exam. Another concern is the low number of students sitting for the exam.

Klamath Falls Assessment, 2011 – 2012 Academic year
Assessment Method: MMET Senior Survey Indirect Assessment

As part of the ME capstone course students were asked to complete a senior survey. The process and general results are briefly explained in Outcome (a) above.

For this outcome, "mechanical systems", 80% felt they were highly prepared and 20% felt prepared. No respondents reported feeling inadequately prepared.

Klamath Falls Assessment, 2014 – 2015 Academic year
Direct Assessment #1 Klamath Campus

The faculty assessed this outcome in MECH 316 Machine Design II Fall term 2014, using a design project scored with a rubric. There were 12 mechanical engineering students involved in the assessment. The results are shown in Table 4.63.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify an engineering problem	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Analysis & assumptions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Formulate a plan	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Apply engineering principles	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%
Document results	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	92%

Table 4.63. ME Assessment Results for SLO ME2, Fall 2014, Klamath Campus

Strengths: Students have relatively good analytical and report writing skills.

Weaknesses: Students had difficulty identifying the problem, making assumptions and formulating a plan to solve the problem.

Actions: Spend more time emphasizing the importance of problem identification, assumptions and formulating a plan to solve the problem.

Klamath Falls Assessment, 2014 – 2015 Academic year
Direct Assessment #2 Klamath Campus

The faculty assessed this outcome in MECH 480 Vibrations Winter term 2015, using a problem scored with a rubric. There were 30 mechanical engineering students involved in the assessment. The results are shown in Table 4.64.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify an engineering	Rubric-scored	1-4 proficiency	80% score 3	100%

problem	project	scale	or 4	
Analysis & assumptions	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	83%
Formulate a plan	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	67%
Apply engineering principles	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	33%
Document results	Rubric-scored project	1-4 proficiency scale	80% score 3 or 4	100%

Table 4.64. ME Assessment Results for SLO ME2, Winter 2015, Klamath Campus

Strengths: Successful identification of system type; Proper application of relevant scientific/engineering principles.

Weaknesses: Frequency Response Misconceptions; Computational Errors; Neglect of Dimensional Units; Disrespect of Significant Figures.

Actions: Reiterate importance of understanding basic concepts, checking all computations, including appropriate units, and expressing correct significant figures.

Seattle Assessment, 2014 – 2015 Academic year

No Seattle campus assessments were completed for this outcome.

Action: This outcome needs to be assessed during the 2015 – 2015 assessment cycle.

Assessment, 2014 – 2015 Academic year
Indirect Assessment #1 MMET Undergraduate Exit Survey (both KF and Seattle)

During the spring term, each graduating senior completes an exit survey. The survey includes questions on how well the program prepared the student on each SLO. This survey data is reviewed by faculty to determine any strengths or weaknesses as perceived by students on this SLO. Student responses over the past three years have been aggregated for this report. There were a total of 30 responses from Klamath Falls seniors and 2 responses from Seattle seniors. Student responses from all locations indicate that 96.5% of students felt prepared in this outcome. Details are included in Table 4.65.

	Highly Prepared	Prepared	Inadequately Prepared
Klamath Falls	58.6%	37.9%	3.5%

Table 4.65. ME Indirect Assessment for SLO ME1, Senior Exit Surveys 2014-15

B. Continuous Improvement

At the end of each academic year the MMET Department holds a Closing-the-Loop Assessment meeting. The purpose of the meeting is to review the results of the yearly assessments, make recommendations for changes in courses/curriculum, and to "close-the-loop" on any changes made the previous year(s).

The summary notes from each year's assessment reports are shown below in chronological order. These summaries show the results of the assessments done that year, any suggested changes, and any closing-the-loop results.

2010 – 2011 Assessment Summary

SUMMARY OF STUDENT LEARNING OUTCOMES & ACTIONS TAKEN

Assessments done for 2010-11 have been reviewed by the faculty. A set of recommendations were developed to address shortcomings or areas where room for improvements is recognized. These recommendations are listed below.

OUTCOME (b) Experimentation

Although improvements can always be made, the faculty is not overly concerned with this outcome. The low scores in "Understanding Experimental Data" in MECH 480 are likely due to the very open ended nature of those labs. The faculty felt efforts could be better applied in other areas.

OUTCOME (g) Communicate Effectively

Communication assessments showed students to be proficient in both oral and written communication. The faculty felt no additional emphasis should be given to this outcome at this time.

OUTCOME (i) Life-long Learning

Students performed well in most areas assessed. The faculty felt areas which showed shortcomings related more to the effort the students gave the assignment than to their abilities. The next time this assessment is given more emphasis should be given to the assignment. This assessment fits so well into ENGR 485 that the faculty felt this assessment should remain there even though this class is pass/fail.

The faculty teaching this class have been asked to stress the intent and effort required. If this is not adequate to motivate the students it may be necessary to make the course in which this assessment is done, ENGR 485, a graded course rather than pass/fail. The faculty felt we should try the less drastic approach first.

OUTCOME (j) Knowledge of Contemporary Issues

The faculty felt the poor performance on this assessment is due more to the assessment tools than to the students' knowledge. The directions to the students will be updated before this assessment is given again. It was also suggested that this assessment be tried again before it is again due in the three year cycle.

OUTCOME (k) Modern Engineering Tools

The faculty felt a rework of the assessment tool, or a change in the assignments used for assessment should be considered.

Actions Items:

- Put more emphasis on the assignment used for Lifelong Learning

- The assessment tool for "Knowledge of Contemporary Issues" needs to be revised. This should be done, along with a trial run of the assessment during winter term 2012.

- The assignments used for "Modern Engineering Tools" should be reviewed and possibly revised before this assessment is given again.

Actions recommended from previous years and the results achieved from those recommendations are detailed below.

- A review of assignments used for "Mathematics, Science & Core Engineering" assessment was recommended prior to the next cycle. The MMET faculty met May 17, 2011 and reviewed the assignments used. It was decided to continue using pre-exams as the primary direct measurement tool. It was also decided to administer these in the same classes as previously done. The only change was to use Vibrations, MECH 480, in place of Advanced Dynamics, MECH 312, as dynamics is now an elective class. (ISLO A)

- A review of assignments used for "Identify, Formulate and Solve Engineering Problems" assessment was recommended. The MMET faculty met May 17, 2011 and reviewed these assignments. After some discussion it was decided to keep the same assignments used in prior years. In spite of Finite Element Analysis, MECH 351, not addressing some of the outcomes, no other course on the mechanics side of the curriculum was felt to be better. Thus, assessment in this course was retained with the realization that some outcomes won't be addressed here. (ISLO E)

- A review of pre-exams was recommended before these are again used for assessment in 2011-12. (ISLO A)

- The effects of adding projects to MET 111-112, MECH 316 and MECH 318 will be assessed during the 2011-12 school year. (ISLO C)

2011 – 2012 Assessment Summary

An MMET Department meeting was held June 4, 2012 where assessment results related to the ME Program were discussed and considered. These discussions and resulting actions are documented in this section.

OUTCOME (a): Mathematics, Science & Core Engineering

The conclusion of the faculty was that this outcome is being met. Although the rubric evaluation of pre- exams showed some scatter, the results overall were encouraging. The FE Exam results are of concern. The goal is to be at or very near the national average and this is not being met.

It is also of concern that few students appear to be taking the exam. This is a graduation requirement and acceptance to the exam is a requirement for ENGR 485. It appears students are taking the first step of the FE Exam to satisfy the graduation requirements but not following through and sitting for the exam.

All the students felt they were well prepared related to this outcome.

Discussions regarding the assignments used were undertaken prior to development of the pre-exams. The conclusion of the faculty was to continue using pre-exams in these courses even though they are less than perfect in evaluating the last performance criteria.

OUTCOME (c): Design a System, Component or Process within Realistic Constraints

- Assessment results from Fluid Mechanics and Machine Design showed room for improvement, particularly in “creating a detailed design within realistic constraints”.
- Assessments from senior projects showed at least acceptable performance in all cases.
- Students felt they were adequately prepared.

The results for this outcome are encouraging. The low evaluations for MET 111/112 aren't of concern as these are incoming freshman. The evaluations from senior projects show good performance.

Term long projects were dropped from MECH 318 and MECH 316 this last year. These projects were not adding to the students' knowledge of project planning and management, but did require significant effort. Thus they detracted from the core material of these courses and didn't achieve their main goal. In place of these projects, an elective in project planning was instituted. It is hoped that enough students will take this elective course to impact project planning and management in senior projects. There all students involved will be exposed.

Once projects were dropped from MECH 318 and MECH 316 those courses could not be used for this assessment. It was later realized that all the projects used for this assessment are a mix of engineering and engineering technology students.

OUTCOME (e): Identify, Formulate and Solve Engineering Problems

The faculty felt this outcome is generally being met. No obvious area of improvement was noted.

The concerns noted above regarding the FE Exam are also applicable to this SLO. The actions noted above also apply here.

OUTCOME (m1): Thermal Systems

The faculty felt this outcome is generally being met. No obvious area of improvement was noted.

The concerns noted above regarding the FE Exam are also applicable to this SLO. The actions noted above also apply here.

OUTCOME (m2): Mechanical Systems

The faculty felt this outcome is generally being met. No obvious area of improvement was noted.

The concerns noted above regarding the FE Exam are also applicable to this SLO. The actions noted above also apply here.

CHANGES DUE TO PRIOR ASSESSMENTS

SLO E Assessment Assignments:
A review of the assignments used for SLO E was completed by the faculty prior to this 2011-12 assessment cycle. Although shortcomings were noted, no better assignments were identified. Thus, the same assignments remain in use.

SLO J Assessment Tool:
Problems were recognized when evaluating the 2010-11 assessment results for this SLO. The students were asked to address, in an open session, one of several contemporary issue questions posed. They gave their thoughts but it was difficult to determine from these their comprehension. A dry run of the assessment was done this year asking them to give their position and also give the opposing position. This run through worked noticeably better than last year's assessment and will be used when this SLO is again evaluated.

SUMMARY

FE Exam Performance:

The faculty decided to offer a review course for the FE Exam starting in fall 2012. This will be an evening course co-taught by faculty. Although not for credit good attendance is anticipated.

FE Exam Participation:

The low number of graduates sitting for the FE Exam was also discussed. It was suggested that we give a mock FE Exam in ENGR 485 and use this for assessment. There are several companies who offer practice exams at a reasonable price. They give similar feedback but without the delays in processing which the FE Exam has. It was decided to continue to require students to sit for the FE Exam but realize the difficulties placed on this requirement by the state board (OSSBLEES).

Adding a practice exam to ENGR 485 will also promote better preparation for the FE Exam and, hopefully, improve student performance.

Project Planning and Management:

This seems to be a continuing challenge for the program. Projects in Fluids and Machine Design were dropped as ineffective. The faculty decided to instead offer a Project Planning and Management elective course. Its effectiveness will be assessed during the next assessment cycle.

ME Specific Projects:

Projects used for evaluation are needed which better targets ME students. The difficulty in finding or developing ME specific projects was discussed. The faculty committed to implementing two projects in more ME specific courses. With less emphasis on project planning and management these projects will be easier to implement but still give assessment opportunities focused on ME students. The specific courses for these projects will be determined during fall 2012 convocation. However, it is anticipated there will be one in a junior course and one in a senior course

2012 – 2013 Assessment Summary

The results from the assessments above will be discussed during the faculty convocation held in September 2013. During that meeting actions will be decided upon to address any weaknesses or, as appropriate, to improve areas showing good, but not excellent, performance. Specifically Changes to ENGR 485 will be assessed. Enrollment in ENGR 445 (project management) will be tracked and the nature of the new projects will be assessed.

CURRENT ACTION ITEMS –

1) “How Faculty manage teamwork”, will be discussed during convocation Sept.2013
2) “Use of oral presentations”, will be discussed during convocation Sept.2013
3) Implementation of past items, will be assessed during convocation Sept.2013

a. ENGR 485 FE Exam
b. ENGR 445 Project management
c. Assignment revisions
d. Increasing projects

FUTURE ACTION ITEMS – to be completed before next assessment cycle, fall 2015

1) To be determined during Convocation 2013
    a. How to track increasing oral presentations and see if conditions improve
    b. What projects will be added and how to determine the effects
    c. How should assessment assignments be revised
    d. Should we use the FE to track technical adequacy to each course

2013 – 2014 Assessment Summary

Summary Recommendations for Outcome (b):

The results shown above indicate that both the Klamath Falls and Seattle students have good experimentation skills. However, the MMET Department needs to do a better job in saving the student work used for our assessment process.

Summary Recommendations for Outcome (g):

The results shown above indicate that both the Klamath Falls and Seattle students have good communication skills. However, both written and oral communications skills need to be better assessed at both campuses.

Summary Recommendations for Outcome (i):

The results shown above indicate that both the Klamath Falls and the Seattle students have the ability to engage in life-long learning. However, this outcome should be evaluated with at least two direct assessments at both Klamath Falls and Seattle.

Summary Recommendations for Outcome (j):

The results shown above indicate that the Klamath Falls students feel that they have knowledge of contemporary issues. However, this outcome should be evaluated with at least two direct assessments at both Klamath Falls and Seattle.

Summary Recommendations for Outcome (k):

The results shown above indicate that both the Klamath Falls and the Seattle students can effectively use the techniques, skills, and modern engineering tools necessary for engineering practice. However, this outcome should be evaluated with at least two direct assessments at both Klamath Falls and Seattle.

SUMMARY OF STUDENT LEARNING OUTCOMES & ACTIONS TAKEN

This year the BSME Program at both Klamath Falls and Seattle assessed outcomes b, d, g, i, j, and k; plus an Oregon Tech-specific outcome on Critical Thinking. The students at both campuses performed well in all of the assessments given. However, for several outcomes the MMET Department did not give the students two direct assessments (most noticeably outcome j, contemporary issues). Also, since the BSME program just started at the Seattle campus there were no students available to take the indirect-assessment senior survey.

RELATED CHANGES DUE TO PRIOR ASSESSMENTS

Last year's action items –

1) How to track increasing oral presentations and see if conditions improve
    - **a.** Oral presentations have been added to MET 112 (Sloan)
    - **b.** Oral reports will continue in MECH 360 (Stuart)

2) What projects will be added and how to determine the effects
    - **a.** Project level assignments have expanded in MECH 417 (Fluids II), MECH 407 (CFD), MECH 315/6 (Machine Design), and with the new course MECH 407 (Combustion engines).
    - **b.** Swanson and Sloan will be monitoring these courses to determine the extent project level problems teach as compared to previous, smaller labs and assignments.

FUTURE ACTION ITEMS – to be completed before next assessment cycle, fall 2015

1) Sign up faculty ownership to revise assessment assignments

2) Review Pre-requisites for each MECH course.

3) Assess Outcome j before the next ABET visit.

4) Organize the material on the T-drive to make it easier to find our assessment material.

5) Assess each outcome with two direct methods and one indirect method; and do this at both the main campus in Klamath Falls and the Seattle campus.

2014 – 2015 Assessment Summary

Summary Recommendations for Outcome (a):

The results shown above indicate that both the Klamath Falls and Seattle students are effectively able to apply knowledge of mathematics, science, and engineering

Summary Recommendations for Outcome (c):

The results shown above indicate that both the Klamath Falls and Seattle students are effectively able to design a system, component, or process to meet desired needs within realistic constraints. It is recommended that this outcome be assessed with at least 2 direct assessments at each campus.

Summary Recommendations for Outcome (e):

The results shown above indicate that both the Klamath Falls and Seattle students are effectively able to identify, formulate, and solve engineering problems. It is recommended that this outcome be assessed with at least 2 direct assessments at each campus.

Summary Recommendations for Outcome (me1):

The results shown above indicate that both the Klamath Falls and Seattle students are effectively able to work professionally in the area of thermal systems. It is recommended that this outcome be assessed with at least 2 direct assessments at each campus.

Summary Recommendations for Outcome (me2):

The results shown above indicate that both the Klamath Falls and Seattle students are effectively able to work professionally in the area of thermal systems. One area that should be watched is the students' ability to apply engineering principles. It is recommended that this outcome be assessed with at least 2 direct assessments at each campus.

SUMMARY OF STUDENT LEARNING OUTCOMES & ACTIONS TAKEN

This year the BSME Program at both Klamath Falls and Seattle assessed outcomes a, c, e, me1, and me2. The students at both campuses performed well in all of the assessments given. However, for several outcomes the MMET Department did not give the students two direct assessments at each campus. Also, since the BSME program started last year at the Seattle campus there were only 2 students available to take the indirect-assessment senior survey.

FUTURE ACTION ITEMS – to be completed before next assessment cycle, fall 2015

1) Assess Outcome me1 at the Seattle campus before the next ABET visit.

2) Organize the material on the T-drive to make it easier to find our assessment material.

3) Assess each outcome with two direct methods and one indirect method; and do this at both the main campus in Klamath Falls and the Seattle campus.

2015 – 2016 Assessment Summary

The 2015 – 2016 Assessment Report is in the process of being written, and will be available during the Fall 2016 visit.

C. Additional Information

Copies of the assessment instruments and materials referenced above will be available for review at the time of the visit. Minutes from meetings where the assessment results were evaluated and where recommendations for action were made will be available at the time of the visit.

CRITERION 5. CURRICULUM

A. *Program Curriculum*

Table 5.1 below shows the plan of study for the students in the BSME program. Oregon Tech is on the quarter system; the program of study is shown in the form of the recommended schedule by year and term. The maximum enrollments for all courses for the last two terms taught are also shown. There are no options in the BSME program, so the there is only one recommended program of study shown. Table 5-1 is shown for both the Klamath Falls campus and the Seattle campus. Note that Seattle program course offering is enrollment-driven; and may vary from the recommended schedule depending on the number of students that require any given course.

The BSME curriculum aligns very well with the BSME Program Educational Objectives (PEO). The first PEO is "demonstrated the ability to analyze, design and improve practical thermal and/or mechanical systems" In the thermal/fluids area the students take six courses; 2 thermodynamics, 2 fluid mechanics, and 2 heat transfer courses. Two of these courses have a laboratory component (and an optional third course). There are several MECH Electives offered in this area as well, such are Introduction to Aerodynamics, Computational Fluid Dynamics (CFD), Experiments in Thermodynamics, Introduction to Wind Tunnels, HVAC, and Reciprocating and Turbine Engines.

In the mechanical design area the students take Statics, Strengths, Dynamics, Vibrations, Machine Design I, and Machine Design II. Students also take CAD for Mechanical Design I and II; Solid Modeling, and Finite Element Analysis. There are several electives in the mechanical design area including Advanced Solid Modeling, Parametric Modeling, Dynamics II, and Composite Design.

Finally, the BSME students take a 3-term Senior Design Project where they apply the material learned in their courses to a comprehensive group design project. This course sequence also adds additional course material in areas such as project management, design optimization, and proposal writing to prepare the students to be successful engineers.

For the next PEO "shown the ability to communicate effectively and work well on team-based engineering projects", the BSME curriculum includes six communications courses. Students also have numerous opportunities to give presentations in their engineering courses and senior projects; and to write laboratory and technical reports in their engineering courses and in their senior projects sequence.

The third PEO is "succeeded in entry-level mechanical engineering positions"; the BSME curriculum with its mix of hands-on and rigorous theoretical background is an excellent preparation for succeeding in the workforce.

The fourth PEO is "pursued continued professional development, including professional registration if desired"; the BSME curriculum includes a several courses such as ENGR 111

MMET Orientation that emphasis the need for continued professional development and the potential for pursuing professional registration.

Finally, the last PEO is "successfully pursued engineering graduate studies and research if desired"; which the BSME curriculum prepares our students for with by providing a solid fundamental and mathematical background. If the BSME students take MATH 465 Mathematical Statistics as their Statistics Elective, then they just need to take one additional math course (MATH 253N Sequences and Series) to obtain their minor in Applied Math.

The majority of the BSME faculty (full-time, part-time, and adjunct) has both higher education experience and industrial experience. As a result, the program is both theoretically rigorous and includes a great deal of hands on applications to solve practical engineering problems. The success of this approach in attaining the program student learning outcomes is reflected in our high graduate placement rates and starting salaries.

The laboratory content that the students are exposed to is a strength of the BSME program. Since the majority of the faculty has industry experience, the BSME curriculum has been set up to give our students the skills necessary to be work-ready when they graduate. Several courses in the BSME program at Oregon Tech are not most BSME programs; these include:

- A full term of welding, which includes 2 hours of lecture and 3 hours of hands-on welding laboratory work per week.
- A full term of machining, which includes 2 hours of lecture and 6 hours of hands-on machining laboratory work per week.
- Geometric Dimensioning and Tolerancing, which includes 2 hours of lecture and 3 hours of hands-on metrology laboratory work per week.

The purpose of these courses is not to turn our students into welders or machinists; it is to give them enough hands-on experience so that when they are designing parts they will have a much better idea of the correct processes, procedures, and tolerances to specify in order to produce successful products. A secondary purpose is to get our students comfortable working down on the "shop floor", so that they will feel confident talking to the welder/machinists when they are working in industry.

Prerequisites required for the students to be successful have been determined by the faculty, and are shown on Figure 5.1 below. Mathematical and basic science prerequisites provide a foundation upon which the engineering curriculum is built.

Oregon Tech's BSME program is on a quarter system, and requires the completion of 192 student credit hours (SCH), of which 105 SCH (54.7%) are discipline specific courses, 48 SCH (25%) are math and basic sciences, and 39 SCH (20.3%) are general education. This meets ABET's 2015-2016 Criteria for Accrediting Engineering Programs, which state that the program must include: *"(a) one year* [i.e., 48 SCH] *of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. […] (b) one and one-half years* [i.e., 72 SCH] *of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. […] (c) a general education* *component that complements the technical content of the curriculum and is consistent with the program and institution objectives."*

The BSME program includes a three term group senior project (capstone) satisfying ABET's general criteria on integration of contents, which states: *"Baccalaureate degree programs must provide a capstone or integrating experience that develops student competencies in applying both technical and non-technical skills in solving problems."* The group senior project at Oregon Tech allows students to use the basic engineering foundation to propose, plan, analyze, design, fabricate and test a project that they select under the supervision of a faculty advisor. The project management and planning part is an integral part of this project as well as the engineering design portion.

The senior project approach is consistent with engineering standards in industry. Students start with a design proposal that includes project description, budget and timeline. The first major portion of the project is to identify the relevant Engineering Standards that apply to their project, as well as any design constraints (for example, students working on the Formula SAE vehicle have an approximately 150 page rule book that imposes numerous design constraints), to create a set of Project Requirements. As the project enters the analysis, design and evaluation phases, the project team conducts status meetings, design reviews and project demonstrations as is done in industry. Written and oral communications are required and are demonstrated in an industrial type design review and final project report.

One of the main focuses of this 3-term senior design project is the students to identify a project, divide the project into design areas, create a set of design requirements (both overall, and for the individual design areas), create several different designs that could meet the requirements, use a systematic system to determine which design best meets the design requirements, combine the individual design areas into an overall design, reevaluate the designs, run detailed analysis, create the final design, test this design, and finally compare the results of the testing to the design requirements. Then, repeat.

At the end of Spring term, the Klamath Falls campus hosts a Student Project Symposium, which is an event intended to showcase the type of projects that students conduct during their studies. The symposium consists of a poster and demonstration event where students from the different programs get to show their work, as well as see other student's projects. Klamath Falls students completing their three-term senior project sequence are required to participate. The event is open to the public, faculty, staff, current and prospective students, educational and industrial partners, and employers.

Students may also take the course MECH 404 Co-op Field practice for one of their mechanical engineering electives. Students must work at least 3 months full-time in an engineering internship; the prerequisite for the course is instructor permission. Prior to taking this course, students must meet with the course instructor and outline the work they will be doing on their internship to make sure that it meets the requirements for an engineering internship. As part of this course, students must write a 10+ page technical paper on their work as an engineering intern; this paper must be approved by the company before it is released.

During the ABET evaluation visit, the department will provide an office space with program exhibits such as university catalogs for the past five years, course textbooks, course folders, and outcome folders. The course and outcome folders will contain course syllabi and student sample work, as well as ABET assignments and ABET rubrics used to assess the different student outcomes. Student samples from senior projects and other major design projects will also be provided. The yearly assessment reports and assessment data and evaluations for the past five academic years will also be provided.

Table 5-1 Curriculum

Bachelor of Science Mechanical Engineering, Klamath Falls

Course (Department, Number, Title) List all courses in the program by term starting with the first term of the first year and ending with the last term of the final year.	Indicate Whether Course is Required, Elective or a Selected Elective by an R, an E or an SE.[1]	*Subject Area (Credit Hours)* Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other	Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Maximum Section Enrollment for the Last Two Terms the Course was Offered[2]
Fall term Freshman year							
CHE 201 General Chemistry I	R	3				*F2014, F2015*	*40, 35*
CHE 204 General Chemistry Laboratory	R	1				*F2014, F2015*	*23, 23*
ENGR 111 MMET Orientation (New course in 2015/16)	R		2			*F2015*	*65 (23Lab)*
WRI 121 English Composition	R			3		*W2016, S2016*	*26, 21*
Humanities/Social Science Elective	SE			3		*W2016, S2016*	*Varies greatly*
Winter term Freshman year							
CHE 202 General Chemistry II	R	3				*W2015, W2016*	*43, 33*
CHE 205 General Chemistry Laboratory	R	1				*W2015, W2016*	*22, 24*

MFG 103 Introductory Welding Processes	R				3	*W2016* *S2016*	*19 (10Lab)* *20 (11)*
WRI 122 Argumentative Writing	R			3		*W2016,* *S2016*	*27, 26*
Humanities/Social Science Elective	SE			3		*W2016,* *S2016*	*Varies* *greatly*
Spring term Freshman year							
MATH 251 Differential Calculus	R	4				*W2016,* *S2016*	*24, 25*
MET 160 Materials I	R				3	*W2016* *S2016*	*21 (12 Lab)* *19 (10 Lab)*
MET 241 CAD for Mechanical Design I	R				2	*W2016,* *S2016*	*14, 15*
MFG 120 Manufacturing Processes I	R				4	*W2016* *S2016*	*21 (11 Lab)* *19 (10 Lab)*
SPE 111	R			3		*W2016,* *S2016*	*25, 23*
Fall term Sophomore year							
MATH 252 Integral Calculus	R	4				*W2016,* *S2016*	*24, 25*
MET 242 CAD for Mechanical Design II	R				2	*W2016,* *S2016*	*9, 13*
PHY 221 General Physics with Calculus	R	4				*F2015* *W2016*	*35 (21 Lab)* *44 (23 Lab)*
WRI 227 Technical Report Writing	R			3		*W2016,* *S2016*	*25, 20*
Economics Elective	SE			3		*W2016,* *S2016*	*32, 34*
Winter term Sophomore year							

ENGR 211 Engineering Mechanics: Statics	R		4			*W2016,S2016*	*29, 19*
MATH 254N Vector Calculus I	R	4				*W2016, S2016*	*30, 19*
PHY 222 General Physics with Calculus	R	4				*W2016 S2016*	*35 (21 Lab) 44 (23 Lab)*
Statistics Requirement	SE	4				*W2016, S2016*	*31, 24*
Spring term Sophomore year							
ENGR 213 Engineering Mechanics: Strength of Materials	R		4			*W2016 S2016*	*14 (10 Lab) 19 (12 Lab)*
ENGR 236 Fundamentals of Electric Circuits	R		3			*F 2015, S 2016*	*24, 32*
ENGR 266 Engineering Computation	R		3			*W2016, S2016*	*9, 14*
MATH 321 Applied Differential Equations I	R	4				*W2016, S2016*	*22, 34*
PHY 223 General Physics with Calculus	R	4				*F2015 S2016*	*40 (21 Lab) 41 (20 Lab)*
Fall term Junior year							
MATH 341 Linear Algebra I	R	4				*W2016, S2016*	*24, 30*
MECH 318 Fluid Mechanics I	R		4			*F2015 W2016*	*38 (14 Lab) 21 (11 Lab)*
MECH 363 Engineering Instrumentation	R		3			*F2014 F2015*	*36 (13 Lab) 25 (12 Lab)*
MET 375 Solid Modeling	R				3	*W2016, S2016*	*14, 14*
MFG 314 Geometric Dimensioning and Tolerancing	R				3	*W2016 S2016*	*18 (13 Lab) 11 (11 Lab)*

Winter term Junior year							
ENGR 212 Engineering Mechanics: Dynamics	R		3			*W2016, S2016*	*29, 16*
ENGR 355 Thermodynamics	R		3			*F2015, W2016*	*35, 13*
MECH 315 Machine Design I	R		3 (√)			*F2015, W2016*	*12, 27*
MECH 360 Engineering Materials II	R		3			*F2015, W2016*	*8, 31*
MET 326 Electric Power Systems	R				3	*W 2016 S2016*	*13 (8 Lab) 19 (12 Lab)*
SPE 321 Small Group and Team Communication	R			3		*W2016, S2016*	*20, 21*
Spring term Junior year							
HUM 125 Introduction to Technology, Society, and Values	R			3		*F2015, S2016*	*33, 31*
MATH 451 Numerical Methods I	R	4				*F2015, S2016*	*20, 30*
MECH 313 Thermodynamics II	R		3			*S2015, S2016*	*30, 41*
MECH 316 Machine Design II	R		3 (√)			*W2016, S2016*	*21, 21*
MECH Elective	SE		3			*S2016, S2016*	*12, 9*
Fall term Senior year							
MECH 323 Heat Transfer I	R		3			*F2015, S2016*	*22, 21*
MECH 351 Finite Element Analysis	R		3			*F2015, S2016*	*13, 14*
MECH 490 Senior Projects I	R		3 (√)			*F2014, F2015*	*14, 20*
WRI 327 Advanced Technical Writing	R			3		*W2016, S2016*	*21, 21*
Fluid Mechanics Elective	SE		3			*W2015 F2016*	*32 (14 Lab) 21*
MECH Elective	SE		3			*F2015,*	*28, 15*

						F2015	
Winter term Senior year							
MECH 437 Heat Transfer II	R		2			*W2015* *W2016*	*33 (15 Lab)* *32 (17 Lab)*
MECH 480 Mechanical Vibrations	R		3			*W2015* *W2016*	*30 (15 Lab)* *33 (18 Lab)*
MECH 491 Senior Projects II	R		3 (√)			*W2015, W2016*	*15, 16*
PHIL 331 Ethics in the Professions	R			3		*F2015, W2016*	*27, 31*
Humanities/Social Science Elective	SE			3		*W2016, S2016*	*Varies greatly*
MECH Elective	SE		3			*W2016, W2016*	*13, 10*
Spring term Senior year							
MECH 436 Classical Control Systems	R		3			*S2015* *S2016*	*33 (17 Lab)* *33 (17 Lab)*
MECH 492 Senior Projects III	R		3 (√)			*S2015, S2016*	*15, 17*
MGT 345 Engineering Economy	R				3	*W2016, S2016*	*31, 29*
Humanities/Social Science Elective	SE			3		*W2016, S2016*	*Varies greatly*
MECH Elective	SE		3			*S2016, S2016*	*14, 7*
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		48	79	39	26		
OVERALL TOTAL CREDIT HOURS FOR COMPLETION OF	192						

THE PROGRAM							
PERCENT OF TOTAL		25.0%	41.2%	20.3%	13.5%		
Total must satisfy either credit hours or percentage	Minimum Semester Credit Hours	48 Hours	72 Hours				
	Minimum Percentage	25%	37.5 %				

1. **Required** courses are required of all students in the program, **elective** courses (often referred to as open or free electives) are optional for students, and **selected elective** courses are those for which students must take one or more courses from a specified group.
2. For courses that include multiple elements (lecture, laboratory, recitation, etc.), indicate the maximum enrollment in each element. For selected elective courses, indicate the maximum enrollment for each option.

Instructional materials and student work verifying compliance with ABET criteria for the categories indicated above will be required during the campus visit.

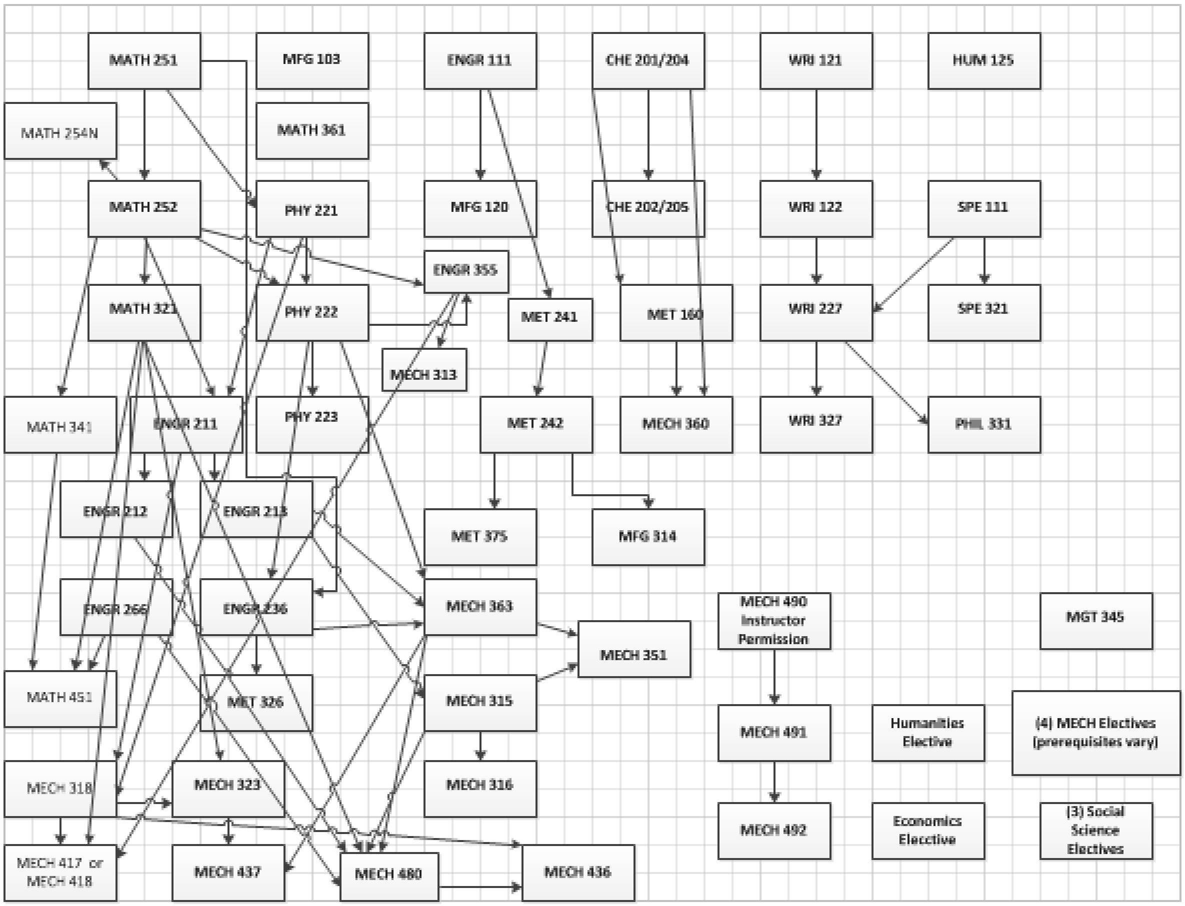

Figure 5.1 BSME Prerequisites

B. Course Syllabi

Appendix A contains a syllabus for each course used to satisfy the mathematics, science, and discipline-specific requirements required by Criterion 5 and any applicable program criteria. The syllabi are grouped similar to the areas shown on Table 5.1; and are shown in the following order:

- Math/Science
- Engineering Topics
- Selected Mechanical Engineering Electives
- General Education (Required courses only)
- Other

CRITERION 6. FACULTY

A. Faculty Qualifications

The MMET department is currently made up of 14 full time faculty members at the 2 locations where the BSME program is offered. There is a good combination of Mechanical, Manufacturing and Industrial Engineering backgrounds, educational degrees and industry experience. The program also utilizes adjunct faculty in a few classes at the Klamath Falls campus and on a much larger basis at the Seattle campus where practicing professional engineers are more available and appropriate for the delivery methods and schedules utilized to deliver program content. See Table 6-1 and Appendix B respectively for the workload table and faculty resumes.

B. Faculty Workload

A full-time teaching load is considered 15 work load units (WLU). Three of these are for faculty research and committee work; the remaining 12 are determined based on one per lecture hour and two for a three-hour laboratory section. A 3-credit class that meets twice per week for 50 minutes and has a three-hour lab once per week has four workload units for the faculty. Please see Table 6-2 for the MMET Faculty Workload Summary.

C. Faculty Size

The MMET department is currently made up of 14 full time faculty members at the 2 locations where the BSME program is offered. At the Klamath Falls campus the full-time faculty are supplemented with several adjunct faculty member. At the Seattle campus anywhere from 15 to 25+ adjunct faculty members supplement the 2 full-time faculty members. The majority of these Seattle adjuncts are Boeing Engineers, with several of them being Boeing Technical Fellows.

The ability of the MMET faculty members to deliver program instruction, develop the appropriate student program outcomes, and provide student advisement is the primary reason that the BSME Program is successful. Faculty diversity (gender and ethnic), technical degrees, level of education, tenure status, industry experience, and professional registration are all important aspects to a well-rounded and effective teaching team. Collectively, the MMET faculty are capable of providing the students with an appropriate breadth of perspective and effective instruction in the use of modern technical and non-technical methodologies in careers appropriate to the PEOs.

All of the faculty in the department have teaching responsibilities. Due to the applied, hands-on nature of the BSME degree program, many of the core courses within the program have a lab and/or project component. Labs associated with a course are typically taught by the same faculty member who is responsible for the course, so that the faculty interact with students both in the lecture room and the laboratory environment.

Faculty are also required to have designated office hours to help students with questions related to course material; the nominal standard is five hours of posted office hours per week.

Faculty members interact with industrial and professional practitioners in a number of ways throughout the year. Faculty members meet with the MMET Industry Advisory Council twice a year. Furthermore, faculty members work with practicing engineers through various research projects. Several of the senior projects for our students are industry projects, so there is a lot of interaction between the faculty and industry professionals.

In their senior year, students are required to complete a 3-term group senior project. Depending on the topic of the project, students are assigned a Senior Project advisor. This advisor works closely with the group of students to define the specifications and guide the progress of the Senior Project.

Academic advising is carried out by the faculty members of the MMET Department. New faculty members are required to complete a New Advisor Training before they can advise students; this training is typically held winter term at the Klamath Falls campus and as-needed at the Seattle campus. Academic advisors are responsible for evaluating students' technical transfer credits, guiding students in the process of creating an academic plan, and periodically meeting with students in order to assess their progress and adjust the academic plan if needed. At the Klamath Falls campus students are required to meet with their advisor once per quarter before they are allowed to register for the following quarter's courses.

Advisors also provide counseling to students regarding career choices and selection of their elective courses to meet their career goals. Upon admission, every student in the program is assigned an academic advisor. Students may later decide to change advisors based on alignment between student's interests and faculty member's areas of expertise.

In addition to instruction and advising responsibilities, faculty are evaluated annually in the areas of professional development and institutional and professionally-related public service. Institutional service responsibilities can be fulfilled by assuming a leadership role within the MMET Department as well as serving in one of the various university-wide committees. Other service opportunities include acting as the faculty advisor for on-campus student organizations, serving on Advisory Boards, and performing outreach activities. Professional development activities include research, industry collaborations, and academic or professional training. More information regarding faculty involvement in activities related to professional development is provided in section D, and shown on Table 6.3.

D. Professional Development

Faculty participate in a variety of professional development activities including research, professional societies, conferences, training/courses and hold positions in outside activities and summer work. Opportunities are regularly announced for faculty at an institutional level and each faculty is given $1000.00 each year to pursue professional development. There are also grants available to support faculty going to conferences and college level support given on a project by project basis through the dean's office. The department supports the use of sabbatical leave for professional development of the established faculty.

The faculty area of expertise and the professional development activities for each faculty member in their area of expertise is shown below in Table 6.3

E. Authority and Responsibility of Faculty

Faculty members are closely involved in all aspects of course development and improvement. This includes having input on course creation, modification, and evaluation. Faculty are also involved in regular meetings (especially at the annual meetings such as convocation, assessment review, and industrial advisory bi-annual meetings). At those times discussions include the definition and revision of program mission, educational objectives, and student outcomes,. The Dean, Provost and Department Chair work together to support faculty and guide the department when necessary on important issues and challenges.

Faculty are responsible for making program revisions based on assessment results and input from the BSME constituents. The BSME Assessment Coordinator leads the assessment effort and coordinates assessment activities; but every faculty member is an active participant in the assessment process.

The BSME assessment plan, as described in Criterion 4, is the starting point for program revisions. The program assesses all student outcomes on a defined three-year cycle. The results of these assessment activities are discussed with program faculty and the IAC members at the fall all-day Convocation meeting and the twice-yearly IAC meetings. The faculty or IAC members may recommend program changes that are discussed and, if approved by both the faculty and the IAC, are implemented as part of the continuous improvement process.

The process of implementation of program revisions depends on the scope of the changes. Some minor changes such as adding different topics to existing courses can be implemented almost immediately and reassessed as the course is taught. Major changes require a more formal approach through the Oregon Tech Curriculum Planning Commission (CPC). The changes recommended by faculty and approved by the department are signed off by the department chair and then the Dean of ETM. The changes are reviewed annually by CPC and if approved are signed off and sent to the Provost office for final approval. This system has various reviews at different levels to ensure quality of program revisions and changes. Any changes to the curriculum are discussed by the program faculty at the annual Spring Closing-the-Loop Assessment meeting.

The BSME program receives support for assessment from the Oregon Tech institutional Assessment Commission under the direction of the institution's Director of Assessment and the Provost's Office. This support includes assistance in developing surveys, alumni database tracking, special workshops and seminars, and review of annual Assessment Reports.

Table 6-1. Faculty Qualifications (part-time and adjunct faculty not included)

Mechanical Engineering

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Wahab Abrous	Ph.D. Mechanical Engineering, 1988	ASC	TT	FT		16	9	PE	L	M	M
David Culler (on Sabbatical Leave during 2015–16 AY)	Ph.D. Industrial Engineering, 1995	P	T	FT	8	12	9	EIT	H	H	M
Irina Demeshko	M.S. Civil Engineering, 1996 M.A. Economics, 2002	ASC	T	FT	6	16	9	Licensed in Design and Re-Construction of Railway Roads, Ministry of Transportation, Russia	M	H	H
Steve Edgeman	M.S. Manufacturing Engineering Technology, 2012	AST	TT	FT	20	7 FT 3 PT	7 FT 3 PT		L	M	M
Yanqing Gao	Ph.D. Mining Engineering, 2010 M.S. Mechanical Engineering, 2001	ASC	TT	FT	16	5	3		H	H	L

	M.S. Industrial Engineering, 2000										
Jeffrey Hayen	Ph.D. Applied Mechanics and Physics, 1996	ASC	T	FT	13	21	5		M	M	H
Don Lee	Ph.D. Robotics, 2009	AST	TT	FT	9	4	3	FANUC Robotics	H	H	L
Nathan Mead	Ph.D. Mechanical Engineering, 1998	P	T	FT	7	20	18	EIT	L	M	M
Josh Millard	M.S. Mechanical Engineering, 2014	VST	NTT	FT	2	1	1		M	M	L
Brian Moravec	M.S. Aeronautics and Astronautics, 1986	P	T	FT	10	27	27	EIT	M	H	L
Randy Shih	M.S. Mechanical Engineering, 1984	P	T	FT	5	33	32	EIT	L	H	M
Sean Sloan	M.S. Mechanical Engineering, 1994	AST	T	FT	9	11	6	EIT	H	H	L
Joe Stuart	M.S. Mechanical Engineering, 1972	ASC	T	FT	33	11	11	PE	M	M	H

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: TT = Tenure Track T = Tenured NTT = Non Tenure Track
3. At the institution
4. The level of activity, high, medium or low, should reflect an average over the year prior to the visit plus the two previous years.

Table 6-2. Faculty Workload Summary

Bachelor of Science in Mechanical Engineering (BSME) Degree Program

Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	Research or Scholarship	Other[4]	
Wahab Abrous (Seattle-Boeing Campus)	FT	ENGR212/3/F15, ENGR355/3/F15, ENGR485/1/F15, MECH437/2/F15, ENGR485/1/W16, MECH313/3/W16, MECH318/4/W16, MECH480/3/W16, MFG507/1/W16, ENGR212/3/S16, ENGR485/1/S16, MECH323/3/S16, MECH417/3/S16, MFG507/1/S16	100%			
David Culler (Klamath Falls Campus)	FT	on Sabbatical Leave during 2015-16 AY	N/A	N/A	N/A	N/A
Irina Demeshko (Klamath Falls Campus)	FT	ENGR213/4/F15, MET241/2/F15, ENGR213/4/W16, MET242/2/W16, MET375/3/W16, ENGR213/4/S16, MET241/2/S16, MET351/3/S16	100%			77%
Steve Edgeman (Klamath Falls Campus)	FT	MET326/3/F15, MET363/3/F15, MFG341/3/F15, MFG112/3/W16, MFG314/3/W16, MFG342/3/W16, MET326/3/S16, MFG314/3/S16, MFG331/3/S16, MFG597/3/S16	100%			60%
Yanqing Gao (Klamath Falls Campus)	FT	ENGR211/4/F15, MFG313/3/F15, MFG314/3/F15, MECH407/3/W16, MET242/2/W16, MFG333/3/W16, MFG596/3/W16, ENGR212/3/S16, MECH407/3/S16, MET241/2/S16, MET407/3/S16, MFG447/3/S16	100%			53%
Jeffrey Hayen (Klamath Falls Campus)	FT	ENGR111/2/F15, ENGR236/3/F15, MECH323/3/F15, MET323/3/F15, ENGR212/3/W16, MECH480/3/W16, MECH323/3/S16, MECH323/3/S16, MECH480/3/S16	75%		25% DC	89%
Don Lee (Klamath Falls Campus)	FT	MECH363/3/F15, MECH490/3/F15, MET490/3/F15, MFG453/3/F15, MFG461/3/F15, ENGR266/3/W16, MECH491/3/W16, MET326/3/W16, MET491/3/W16, MFG462/3/W16, ENGR236/3/S16, MECH407/3/S16, MECH492/3/S16, MET492/3/S16, MFG463/3/S16, MFG596/3/S16	100%			50%
Tony Marostica	PT	MFG120/4/F15, MFG120/4/W16, MFG120/4/S16	N/A	N/A	N/A	N/A

(Klamath Falls Campus)						
Nathan Mead (Seattle-Boeing Campus)	FT	ENGR485/1/F15, MECH315/3/F15, MECH490/3/F15, MFG428/1/F15, MFG507/1/F15, MECH316/3/W16, MECH407/3/W16, MECH491/3/W16, MET326/3/W16, MECH351/3/S16, MECH363/3/S16, MECH436/3/S16, MECH492/3/S16	100%			
Josh Millard (Klamath Falls Campus)	FT	ENGR355/3/F15, MET160/3/F15, MFG454/3/F15, ENGR355/3/W16, MET160/3/W16, ENGR211/4/S16, MECH407/3/S16, MET160/3/S16	100%			40%
Brian Moravec (Klamath Falls Campus)	FT	ENGR407/1/F15, MECH418/3/F15, MECH490/3/F15, MET490/3/F15, MFG461/3/F15, MECH437/2/W16, MECH491/3/W16, MET437/2/W16, MET491/3/W16, MFG462/3/W16, MECH407/3/S16, MECH492/3/S16, MET313/3/S16, MET492/3/S16, MFG463/3/S16	75%		25% PD	41%
Anne-Marie Riechmann (Klamath Falls Campus)	PT	ENGR266/3/F15, MET242/2/F15, ENGR266/3/W16, MET241/2/W16, ENGR266/3/S16, MET242/3/S16	N/A	N/A	N/A	N/A
Randy Shih (Klamath Falls Campus)	FT	MECH351/3/F15, MET375/3/F15, ENGR211/4/W16, MECH475/3/W16, MET375/3/W16, MET475/3/W16, MECH351/3/S16, MECH407/3/S16, MET375/3/S16, MET407/3/S16	100%			73%
Sean Sloan (Klamath Falls Campus)	FT	MECH318/4/F15, MECH407/3/F15, MFG596/3/F15, MECH318/4/W16, MECH407/3/W16, MET426/3/W16, ENGT415/3/S16, MECH313/3/S16, MET218/4/S16	100%			84%
Joe Stuart (Klamath Falls Campus)	FT	MECH360/3/F15, MECH407/3/F15, MECH490/3/F15, MET360/3/F15, MET407/3/F15, MET490/3/F15, MFG507/1/F15, MFG598/3/F15, MECH360/3/W16, MECH491/3/W16, MET307/3/W16, MET360/3/W16, MET407/3/W16, MET491/3/W16, MFG307/3/W16, MFG343/3/W16, MFG407/3/W16, MFG462/3/W16, MFG507/1/W16, MFG598/3/W16, REE307/3/W16, MECH492/3/S16, MET407/3/S16, MET492/3/S16, MFG344/3/S16, MFG407/3/S16, MFG463/3/S16, MFG507/1/S16, MFG598/3/S16	100%			42%
Matt Walter (Klamath Falls Campus)	PT	MFG103/3/F15, MFG103/3/W16, MFG103/3/S16	N/A	N/A	N/A	N/A
Various Adjunct Instructors (Seattle-Boeing Campus)	PT	Various Support Courses	N/A	N/A	N/A	N/A

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution

2. For the academic year for which the Self-Study Report is being prepared.

3. Program activity distribution should be in percent of effort in the program and should total 100%.

   DC = Department Chairperson, PD = Program Director

4. Indicate sabbatical leave, etc., under "Other."

5. Out of the total time employed at the institution.

Table 6.3 Faculty Professional Development (Full-time Faculty)

Wahab Abrous	Specialty Areas: • Computation of Radiation Shape Factors for Orbiting Structures • Mathematical Modeling of Turbulent Natural Convection in Enclosures • Building Thermal Envelopes Heat Transfer • Load paths, gravity loads, and lateral loads on residential structures Professional Development (2014-2016) • Took course "Introduction to Thermal Imaging". • Attended workshops with Simpson Strongtie in Kent, WA on updates of the International Building Code as it relates to fastener design. • Attended workshops with Washington State University on updates on the energy code as it relates to thermal design of residential structures. • Consulted in area of forensic engineering • Consulted in area of lateral engineering of residential structures • Implementing LabView programming in enhancing laboratory data acquisition capabilities of selected laboratory equipment JOINED ASME AS A MEMBER JOINED ASEE AS A MEMBER
David Culler	(on Sabbatical Leave during 2015–16 AY)
Irina Demeshko	Specialty Areas: Stress Analysis 3D Modeling using Creo, Inventor, and SolidWorks Rapid Prototyping (3D Printing) Professional Development Activities (last five years only) Completed online workshops in Creo 3.0 (Solid Modeling program). The software has annual updates.

	Completed annual training in Inventor (Solid Modeling program). The software has annual updates. Took online courses to develop skills and knowledge related to Camtasia Studio. Taking online courses related to rapid prototyping, specifically 3D printing. Attended WomenTech Educators Webinars. Developed resources for Advanced Aerospace Manufacturing Education Project. Attended Engineering Ambassadors Workshop in Corvallis, OR. Attended the 3-day Project Lead the Way Planning Session 2011, 2012, and 2013. Project Lead the Way Affiliate Professor for Intro to Engineering, taught core curriculum at summer training for the last 8 years.
Steve Edgeman	Does not teach Engineering courses, but does teach Other required BSME courses.
Yanqing Gao	Specialty Areas: *Mathematical Modeling of Dynamic Systems *Lean Manufacturing *Quality Improvement *Optimal Design Flexible Robotic Manipulators PD Activities (2011-2016) *Guest editor of Special Issue on Mechatronic and Embedded Systems and Application in ITS, IEEE Transaction on ITS, December 2015 *Associate Editor, IEEE Transactions on Intelligent Transportation Systems, 2013-Present *Chair, IEEE Technical Activities Sub-Committees on Mechatronic and Embedded Systems in ITS, 2014-present *Chair, ASME MESA Technical Committee, 2014-2015 Paper Published *Y.Q Gao, F.Y. Wang, etc., "A Social Manufacturing Laboratory for CDIO Education of CPSS-based Production and Operation", final paper accepted by 2016 ASEE Annual Conference. *Sun, W.P., Gao, Y.Q., 2015, "Teaching statistical quality control by applying control charts in the catapult shooting experiments", June 2015 ASEE Annual Conference & Exposition.
Jeffrey Hayen	Specialty Areas: * Mathematical Modeling of Physical Systems

	* Analysis, Design, and Control of Dynamical Systems * Rocket Thermodynamics Assessment * Computational Analysis and Simulation of Physical Systems PD Activities (2011–16): * Presented original materials on engineering and mathematics at regional conferences * Attended workshops on nanotechnology, FPGAs, and ARM microcontrollers * Consulted on thermodynamics and propulsion analysis for the aerospace industry * Served as a reviewer for engineering archival journals and national conference proceedings * Served as a reviewer for widely-adopted engineering textbooks * Participated in ASME webinars on Stepper Motors, MEMS Simulations, and Computational Heat Transfer in Fluids and Solids * Published a technical article for the 2015 ASEE national conference (Seattle, WA)
Don Lee	Specialty Areas: * Robotics and Robot Mechanisms in the areas of Aerial Vehicles, Ground Vehicles, Marine Surface Vessel, and Submersible Vehicles * Material Handling & Operation and Vision Technology of Industrial Robotic and Mechatronic Systems especially, Automation and Robotics in Manufacturing and automated systems * Cleantech Technologies including electrical power systems, wind turbines, smart manufacturing systems, and precision agriculture * Dynamic Modeling of Electro-mechanical Systems * Analysis, Design, Control, and Solving Problems in General Engineering Systems Professional Development Activities (2013–16): * Published research papers & book chapters in the area of specialty and robotics at journals & book publishing Inc. * Presented research papers in the area of UAV and its control at international conferences * Attended training course to acquire advanced robotic system, iR-Vision, in FANUC industrial robot system as well as acquired certification for material handling and operation programming of the Robotics. • Book Editor, Systems and Control of Nonlinear Equations, INTECH Publishing 6/’15 –Present • Book Editing Panel, CRC Press in Tayler and Francis Group 8/’15 –Present • Review Editor in the Journal Editorial Boards as follows: 1. “Robotic Control Systems” section of the Journal in Robotics and AI, Frontiers, 5/’15 - Present

	2. "Mechatronics," section of the Journal in Mechanical Engineering, Frontiers 6/'15 - Present (http://loop.frontiersin.org/people/235917/overview) 3."International Journal of Advanced Robotic Systems," INTECH, 01/'16 - Present (http://www.intechopen.com/journals/articles/international_journal_of_advanced_robotic_systems/82/all/1) * Referee as the reviewer for journal papers (IEEE Trans. On Automatic Control, JSR) * Compete Regional Underwater Robotics Competition, MATE Ranger, Apr. 2015, N. Bend, OR * Consulted on regional company, Rogue Rover, for developing new electric ATV (all-terrain-vehicle) and completed the technical report as the PI for Oregon BEST Project (CG-SOW-2014-OIT-RR) * Research and Innovate Technology for Wind Turbines, Robotics for Underwater Environments, Facilitate student projects, help them to develop business model for the projects as co-worker and advisor * Networked with (1) Klamath IDEA in the Klamath County Chamber of Commerce to increase Oregon Tech Visibility, foster entrepreneurship via student projects, and create partnership with local industry and government (2) Attended Southern Oregon Angel Conference at Jacksonville.
Nathan Mead	Specialty Areas: • Computer-aided Design and Computer-aided Manufacturing Systems • Mechanical Design and Computational Design Tools • Automated Manufacturing Systems and Industrial Controls • Design for Manufacturing PD Activities (2011–16): • Worked with an agricultural equipment manufacturer on the design and manufacture of new orchard equipment. • Worked with an agricultural equipment manufacturer on improving the design and manufacture of existing orchard equipment. • Worked with a small manufacturer on the design and manufacture of custom cello components. • Worked with a small manufacturer on the design and manufacture of custom bicycle components. • Design and construction of numerous laboratory experiments and related equipment.
Josh Millard	Specialty Areas: Solid Mechanics and Material Behavior

	Fracture and Failure Analysis Polymer and Composite Materials PD: Consulted with several Masters and PhD projects at SDSM&T. Consulted with several undergraduate projects at SDSM&T. Assisted in the development of sustainability laboratory experiments at SDSM&T. Restructured vibrations laboratory experiments at SDSM&T.
Brian Moravec	Specialty Areas: • Fluid Power Systems • Thermo-fluid sciences • Off-road vehicles and formula-style vehicles Professional Development Activities: • Member of SAE since 2004 • Project Lead The Way Affiliate Professor since 2006 • Co-PI for Oregon Best funded project (Kerstech) to develop a computer model for a hybrid diesel/hydraulic automotive drive system, and an electric/hydraulic drive system. • Acting Co-PI for NSF-funded Advanced Aerospace Manufacturing Education Project. • Attended the NSF ATE PI conference in Washington DC during 2012 and 2013. • Wrote the Introduction to Statics module for the Aerospace Manufacturing education project. • Co-PI on the Oregon Best Rogue Rover Project. • Attended Advanced Hydraulic Theory and Modeling using Easy5 Workshop in September 2015 at the MSC Office in Bellevue, Washington. • Working on collaboration with CD-Adaptco and approximately 15 Professor from around the US to create fluid mechanics and heat transfer modules to be used with STAR CCM+ CFD software. • As faculty advisor to the Formula SAE and Baja SAE teams at Oregon Tech I annually attend the week-long Formula SAE and Baja SAE competitons/presentations.
Randy Shih	Specialty Areas:

	* Computer Aided Design / Computer Aided Engineering * Engineering Graphics * Finite Element Analysis * Parametric Modeling * 3D Printing * Mechanism Analysis and Simulations PD Activities (2011–16): * Attended workshops on PIC and Arduino microcontrollers * Consulted on computer aided design and solid modeling for the blue algae industry * Served as a reviewer for engineering national conference proceedings * Served as a reviewer for engineering textbooks * Presented and published a technical article at the 2015 ASEE national conference * Publication: Introduction to Finite Element Analysis Using SolidWorks Simulation * Publication: Parametric Modeling with SolidWorks, SDC publications * Publication: Parametric Modeling with UGS NX, SDC publications * Publication: Introduction to finite element Analysis Using Creo, SDC publications * Publication: Tools for Design, SDC publications * Publication: Learning Autodesk Inventor, SDC publications * Publication: Autodesk Inventor and Engineering Graphics, SDC publications * Publication: AutoCAD Tutorial: 2D fundamentals SDC publications * Publication: AutoCAD Tutorial: 3D Modeling, SDC publications * Publication: Principles and Practices, SDC publications * Publication: Parametric Modeling with Creo Parametric, SDC publications * Publication: Learning SolidWorks, SDC publications * Publication: SolidWorks and Engineering Graphics, SDC publications
Sean Sloan	Specialty Areas: • Fluids • HVAC • CFD • Lasers PD Activities (2011-2016): • Attended 3-day seminars on CFD 2012, 2014. • Completed $20,000 grant from Oregon Best on Solar Powered Ventilators.

	• Obtained $200,000 grant for a high power laser for Oregon Laser Institute • Obtained $50,000 Laser Doppler Velocimeter for $10,000 of OIT money • Various Webinars on CFD and heat transfer • Advanced state of the art with thermal syphon technology for heat pumps • Member NWCSM manufacturers consortium
Joe Stuart	Specialty Areas: * Materials – metals, ceramics, polymers * Composite materials * Problem Based Case Learning Techniques * Ocean Wave Energy * Renewable Energy manufacturing applications PD Activities (2011–16): * Presented original materials on ‘Just In Time’ feedback for improved learning at several ASEE National Conferences * Worked on NSF grant #419 as PI for OIT and am working with national team from ASU and NC A & T on ‘Just in Time’ feedback for students by using video, social media and other resources to understand and clarify ‘Muddiest Points’ in materials courses. * Worked on assessment as program director for Manufacturing Engineering Technology working with other campuses on assessment also. Wrote and updated ABET report. * Worked on NSF grant # 1245132 co PI This project, entitled "Collaborative Research: Development of a Sophomore-Level Course "Introduction of Renewable Energy Manufacturing" and Faculty Expertise," and contributing to writing a text on manufacturing of renewable energy machines- my contributions are in the area of Ocean Renewable Energy. * Develop new concepts for coursework in composites, working with National Resource Center in Washington also using Problem Based Case Learning techniques. * Served as a reviewer for widely-adopted engineering textbooks * Presented workshop at ASEE meeting in June 2013 (Atlanta, GA) on ‘Muddiest Points’. Also presented at ASEE 2014 in June in Indianapolis both a paper and a workshop: “Fast Formative Feedback using Muddiest Points and Just In Time Tools in Engineering Material Courses”. * Piloted a new course in Spring 2014 –‘Introduction to Renewable Energy Manufacturing’. * Attended Oregon Wave Energy Trust conference in September 2012 and hosted a panel on Oregon Wave Energy 2.0 ‘the next wave’ * Attended NSF team conference at ASU and held a workshop on developing ‘Muddiest Points’ and how to

	implement this concept in the materials science classroom for fast formative feedback.

CRITERION 7. FACILITIES[1]

A. Offices, Classrooms and Laboratories

Summarize each of the program's facilities in terms of their ability to support the attainment of the student outcomes and to provide an atmosphere conducive to learning.

1. Offices (such as administrative, faculty, clerical, and teaching assistants) and any associated equipment that is typically available there.

Klamath Falls Campus

Each faculty member has a dedicated office located in Boivin Hall equipped with computer, phone and Internet access. Also located in the office area are mail boxes, office supplies, and copy and fax machines for faculty use. The MMET Department is supported by clerical staff also located in Boivin Hall. Office space for teaching assistants is located in Cornet Hall in close proximity to the labs.

All Klamath Falls campus classrooms used for lecture courses in the Mechanical Engineering program are equipped with presentation computers and projectors, as well as white and/or black boards and appropriate seating for the class size.

There are two computer labs located in Boivin Hall dedicated to CAD and Solid Model Programing classes with 30 workstations loaded with appropriate software, and 2 dedicated printers. The current computers are Dell OptiPlex 7010 with dual-monitors. Upgrades to these computers vary depending upon university resources; the high-end computers are normally upgraded every one-or-two years.

Seattle Campus

Office space at the Seattle campus is located at two locations, in Renton and Everett. There are currently three full time people working in Seattle, two full time faculty and an administrative assistant; the Program Director's position is currently vacant and a search is underway. The program has an office in Renton, and both offices/laboratories in Everett. The programs are taught at several locations in the Seattle area, with the majority occurring in Renton and Everett. Classes and meetings with students typically occur at these sites. Faculty have office hours in Boeing conference rooms, the Everett office, and at the Everett Lab.

Lectures facilities are provided by the Boeing Company. These are typically in conference rooms equipped with computer projection equipment and white boards. The facilities for classes would be considered excellent. Some lecture courses are also held in the three lecture rooms at the Everett Laboratory, and occasionally some labs are held off-campus, typically at a community college.

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[1] Include information concerning facilities at all sites where program courses are delivered.

Students at the Seattle campus have access to all the online library resources available through OIT. This includes dozens of bibliography search engines. All of the students attending OIT Seattle are employees of Boeing. They have access to the library facilities of Boeing both physical and electronic. The combination of these provides students an excellent library resource.

The facilities at the Seattle campus are quite adequate. The office arrangements have been improved with the expanded area at the Everett site, but with delivery in two locations the current arrangement works well. Laboratory facilities are adequate for the anticipated number of students. All in all, the facilities are adequate to support the programs offered.

2. Classrooms and associated equipment that are typically available where the program courses are taught.

The Klamath Falls campus has multiple buildings with more than adequate classroom space for the ~2,200 students on campus. Most of the classrooms are small in size to keep class sizes under 25. There are some auditorium-style class rooms that are used for some larger classes or special conference presentations. The basic classrooms have adequate board space (mix of chalk boards and whiteboards) and most have networked computer projection systems that allow different modes of instructional delivery. Many of the smaller classrooms are equipped with smart-boards to allow more interactive instructional delivery and integrating labs and lecture. There are some specialized classrooms that are structured for speech and project classes. They have a side room that is used for taping the classroom session using a multimedia lab technician.

The BSME classes are typically scheduled in Boivin Hall, which houses the MMET Departmental faculty offices. The BSME labs are located in Cornett Hall. General education and service courses such as math, chemistry, physics, writing, speech and general studies may be offered in other buildings on campus. The campus layout is such that students have adequate time to move between classes even if they are scheduled in different buildings. The majority of the classrooms are geared to keep class sizes under 25, which is a focus of the university.

The Learning Resource Center includes the campus library with some special student study rooms and carrels. The College Union building provides small conference rooms for use by faculty, staff and students. These are used by most faculty committees and commissions as well as student clubs and organizations for meetings and functions. Although the campus is small it has more than adequate classroom and other facilities to support program classes and faculty/student activities.

Classes at the Seattle campus are taught at either the Oregon Tech Laboratory building in Everett, which has 3 small classrooms; or in Boeing conference rooms. These conference rooms typically have computer projectors and whiteboards.

3. Laboratory facilities

Klamath Falls Campus

The following labs located in Cornet Hall are dedicated to courses that students in the MMET Department use throughout their coursework in the program. Students have access to these labs when registered in the corresponding course during supervised lab hours which vary by course. Detailed lists of equipment available in these labs are included in Appendix C of this report.

Materials and Heat Treatment Labs, 2538 sq. ft.
Strength of Materials Lab (at alternative times used by Civil Engr.), 983 sq. ft.
Composites Lab, 2894 sq. ft.
Metrology Lab, 374 sq. ft.
Wind Tunnel Facility (2x2 Low-speed), 3705 sq. ft. (elective use)
Fluids and Heat Transfer Lab, 1213 sq. ft.
Fluid Power/HVAC Lab, 1178 sq. ft.
Clean Room, 160 sq. ft. (elective use)
Machine Shop and CNC Lab, 10, 940 sq. ft.
CNC Control Room, 714 sq. ft.
Welding Lab, 7551 sq. ft.
Lean Manufacturing Lab, 584 sq. ft.
Instrumentation, Vibrations, and Controls Lab, 1111 sq. ft.
Electrical Power and Robotics Lab, 2894 sq. ft.
Senior Design Center, 1497 sq. ft.
SAE Baja and Formula Lab, 1612 sq. ft.
Senior Projects Lab (and Technician office), 3414 sq. ft.

Permanent laboratory space was found in spring 2009. The space, in Everett Washington, was located and a 4-year lease was signed. The laboratory is located at 2615 West Casino Road, Everett, WA. Details of the lease included upgrades to the electrical system of the building to meet the needs of the laboratory equipment. The laboratory area is over 1800 square feet; with an additional 200 square feet of office and classroom area. In addition, arrangements have been made with local community colleges to rent laboratory facilities.

B. Computing Resources

Oregon Tech provides and makes available 13 labs consisting of 175 computers for use by the Mechanical Engineering program at the Klamath Falls Campus. These labs in located in a number of different lecture buildings, the Oregon Tech library, and in lab areas. In addition to these labs there are also labs and computers available at the Oregon Tech Boeing Seattle/Everett Campus. Many industry leading software packages are utilized in the computer labs among which include Creo, Autodesk's AutoCAD package, SolidWorks, Catia, Delcam FeatureCam, Matlab and STAR-CCM+. The computer resources and their availability are adequate for the necessary training and research needs of faculty and students in the Mechanical Engineering program. The computer lab hours are currently Monday – Thursday 7:30 am – 9:00 pm; Friday 7:30 am – 5:00 pm, Saturday and Sunday 10:00 am – 4:00 pm. Students are welcome to use any of the computer labs whenever a class is not in session (the class times are posted on the door of each lab).

Computer maintenance is done through the campus ITS department on an as needed basis for repairs and during campus breaks for upgrades and maintenance. Any new software applications are handled by ITS personnel and not program faculty (typically scheduled for summer break). Minor servicing is done through the ITS Helpdesk and student employees usually with a less than 24 hour service call.

At the Seattle location, all students are employees of Boeing and use their Boeing supplied laptops for coursework. These laptops are maintained by Boeing, which is a great asset to the Oregon Tech programs. Faculty have similar laptops provided by Oregon Tech. There are a number of computers in the laboratory facilities for data acquisition and other dedicated purposes. The lab computers are adequate.

Using Boeing supplied laptops there are restrictions on what software can be loaded onto these computers. However, there are many software packages that the students can request.

C. Guidance

Klamath Falls Campus

In order to provide students with appropriate guidance, safety discussions and written reports with safety instructions are provided to students at the beginning of each lab based course. . Students will be reminded of violations or unsafe practices and repeat issues will affect their course grade. Training is specific for the equipment and tools to be used for each course. Teaching Assistants and/or faculty provide supervision and remain present during any open lab times. The Mechanical Engineering program emphasizes good housekeeping, by posting safety instructions, providing lockers for storing materials and tools, designating clean up times, requiring personal protective equipment where necessary, providing appropriate lighting and ventilation, and guarding and training on any dangerous equipment. Hazardous materials are labeled and stored in approved lockers and controlled by faculty. Material safety data sheets are available in the MMET Lab Manager’s office and the Risk Management office, both located in Cornet Hall. Safety and preventative maintenance habits are emphasized in many classes and documented in lab manuals. See the following pages for examples of safety and maintenance from student lab manuals and equipment docs.

Seattle Campus

Full time and part time faculty, as well as part time technical support provide the resources and guidance for students taking courses in Seattle. The labs and equipment are located entirely at the Everett facility and many of the faculty are Boeing engineers with many years of experience using the types of devices and machines available to support courses. Some lower level courses requiring hands-on activities such as machining and welding are held at the local community college which has established procedures and safe practices that must be followed by all OIT students taking classes at that location.

MACHINE SHOP SAFETY RULES:

1. Always wear goggles or safety glasses (eye protection).
2. If in doubt about the safe use of a machine or process, ask an instructor or lab technician.
3. If shop injury should occur to yourself or fellow student, report it to an instructor at once.
4. Emery wheel supports should not be more than 1/16" away from the emery wheel. Make adjustments or get necessary help.
5. Be extremely careful with your fingers when cutting on saws and grinders.
6. Never stop a lathe by applying hand pressure to the chuck.
7. Always remove chuck wrench from chuck when not in use.
8. Never pull metal shavings from lathe or drill press. Use an adequate tool or hook.
9. All shirt sleeves, sweaters, etc., should be rolled up to elbow length or higher.
10. Running and pushing are prohibited in the machine shop.
11. Never use a file for a hammer, or pound on a file, or materials that have the same hard qualities - serious eye injury might result.
12. Always use a file handle when filing.

SHOP RULES:

1. Make sure that all tools are returned to tool crib at the end of each period.
2. Clean all benches or machines being used at the end of every period.
3. Never lay tools or materials on the ways or machined surfaces or equipment.
4. Never use a micrometer or calipers on work when the machine is in motion.
5. Use oil on emery paper when polishing, to prevent the fine grit or dust from settling on the machined surfaces and bearings of the machine.
6. Disengage lead screw when not in use, oil the machine, but not motor.
7. Do not use cutting oil when oiling machine.
8. Make sure work is secure on table when drilling, milling, etc. Use precaution.
9. Run center drill and small drills and cutters at high speed.
10. Use center lube on tailstock centers.
11. Never shift gears when machine is running.
12. Do not use tail stock centers for hammers or punch.
13. Do not stop machine by reversing switch.
14. Make sure the tool you get from tool crib is the correct size.
15. Make sure machine feed levers are disengaged before starting machine.
16. Use a four-jaw chuck when possible - it has 4X the gripping power of a three-jaw chuck.
17. Use cutting oil when tapping or drilling.
18. Be willing to teach others when called upon; you learn by doing and by teaching.
19. No smoking inside of machine shop or classroom area.

GENERAL RULES

1. Never shift machines into gear when they are in motion.
2. Never lean on a machine; you may accidentally put machine into motion.

TOOL AND EQUIPMENT REQUIREMENTS:

It is the Students Responsibility to Purchase and Bring to Class:

Note: You must have the first 7 items (•) by the end of week 1 of classes:

- Safety Eye Protection, Prescription Glasses Okay, But They Will Pit
- 6-Inch Rule, Steel With 4R (1/32) Graduations (some have a drill gage attached)
- 10" Double Cut Smooth File With Handle
- 6" Dial or Digital Caliper
- Combination Center Drill And Countersink, Size #4
- Lathe Center Gage
- 2- 5/16" Tool Bit Blanks

Optional but Recommended Tools / Supplies:

- ✓ Straight Screwdriver Approximately 6 To 8 Inches Long With About 3/16" Wide Blade
- ✓ Allen Wrench Set – (English / Metric): can fold into a handle, with 3/8" The Largest Size
- ✓ Six-Inch Adjustable Spanner Wrench (Crescent Wrench)
- ✓ Pocket Scriber
- ✓ Folder for Blueprints, Operations Sheets, Etc.
- ✓ 6" Slip Joint Pliers
- ✓ Shop Rags, Pencil, and Toolbox
- ✓ 6" Dividers (optional)
- ✓ A Paint Brush 2 To 3 Inch Wide (For Brushing Chips)
- ✓ Hammer
- ✓ Center Punch
- ✓ Drill Grind Gage

Very Important:

- No Loose or Bulky Clothing
- Eye Protection Is Required At All Times
- Report any accidents or injuries to the professor immediately

LABORATORY GUIDE SHEET:

Lab. Purpose: The lab experience is intended to give hands-on reality to the learning process. You are NOT being trained as a machine operator. Your knowledge of machine functions, purposes, capabilities, and limitations must EXCEED that of a machine operator. This can be achieved by: study of the text, observation, note taking and study of the demonstrations, thoughtful operation of the machines and related equipment.

Try to see and understand the general principle of what's happening. Most often we will be tearing off a piece of steel (a chip) to make the rough stock closer to our goal of the finished piece as specified on the drawing. To do this we need a cutting tool that is "sharp" and harder than the stock being cut. Some of the cutting tools you will use are:

Grinding wheels
Whet stones
Emery cloth
Drills
Saws: Band *I* Hack *I* Hot.
Lathe bits
Milling cutters
Files

Believe it or not, they all work in much the same way -- a general principle. They all tear away a small piece of stock (a chip). They all generate heat in the process of making chips. If the tools are dull or the wrong shape or orientation, they generate heat without making any chips. They can only produce chips if the sharp cutting edge gouges into the piece part.

Your text and the lectures will discuss the variety of cutting tools. Your lab activities will give you a chance to see them work. Use your mind to pull theory and practice together. Good theory works in practice. Good practice can be generalized into a theory.

Lab. Activities:

There are 7 assignments to be completed and graded during the Quarter. During each Quarter there are about 56 "hours" of available time for each lab section. (There may be some minor variation due to holidays). Note: Allow for a 10 minute clean-up at the end of each session. You are responsible for cleaning the machines you use and for returning all equipment to its proper place.

D. Maintenance and Upgrading of Facilities

Klamath Falls Campus

The MMET Department employs a full-time (12 month), experienced lab manager to install and maintain lab equipment. Student lab fees are used to buy minor pieces of equipment and consumables. Internal and external grants and donations are solicited for major equipment needs. The MMET Department evaluates facilities and equipment needs several times each year and makes recommendations for upgrades by location when appropriate.

Seattle Campus

A part-time technician is employed to maintain the laboratory facilities. Currently this position is filled by a graduate student who obtained an undergraduate degree through the Seattle program. Thus, he is familiar with the lab equipment. He is available about 10 hours per week. With some faculty assistance this support is adequate for the lab facilities in Seattle.

Maintenance

The primary goal of maintenance is the avoidance and diminishment of consequences due to failure of equipment. The key denominator in assisting with the avoidance of equipment failures is a phrase referred to as, Preventative Maintenance. Preventive Maintenance is designed to preserve and restore equipment reliability by replacing worn components before they fail.

Preventive maintenance is a schedule of maintenance actions aimed at the prevention of breakdowns and failures of paraphernalia. The primary goal of preventive maintenance is to prevent the failure of equipment before it actually occurs. This maintenance is designed to preserve and enhance equipment reliability by replacing worn components before they actually fail. Preventive maintenance activities include, equipment checks, partial or complete overhauls at specified periods, oil changes, lubrication and so on. In addition, students can record equipment deterioration so they are aware of how to replace or repair worn parts before they cause system failure. Recent technological advances in tools for inspection and diagnosis have enabled even more accurate and effective equipment maintenance. The ideal preventive maintenance program would prevent all equipment failure before it occurs.

Long-term benefits of preventive maintenance includes:

- Improved system reliability.
- Decreased cost of replacement.
- Decreased system downtime.
- Better spares inventory management.

Long-term effects and cost comparisons usually favor preventive maintenance over performing maintenance actions only after the system fails.

Regular cleaning and maintenance will help to assure that the CNC lathe will maintain its service life and accuracy for many years. This unit will cover basic lathe maintenance. The procedures you find within this document should be able to be performed by the instructor and beginning students. Lathe maintenance that requires more extensive disassembly should only be done by, or under the supervision of, qualified personnel.

OREGON INSTITUTE OF TECHNOLOGY
Mfg. / Mech. Engineering & Technology
Machine Maintenance Checklist

Name and Description Machine:

Tong IL
CNC Lathe with Fanuc series O-T controller

Tools and Supplies Needed: Set of standard Allen wrenches range from (3/8"- 1/16"), Adjustable wrench, Paint brush, Simple Green, Coolant (Synkool), Lubrication oil (Shell way oil), Hydraulic fluid

ITEM (See manual for help)	Completed	Comments Remarks/tools
Hydraulic fluid check (Fill if needed w/ recommended hydraulic)	☐ ☐ ☐ ☐	
Coolant check (Fill if needed w/ synkool coolant)	☐ ☐ ☐ ☐	
Replace coolant (per term/ or determined by use w/ synkool coolant)	☐ ☐ ☐ ☐	
Clean coolant filter screen (When needed)	☐ ☐ ☐ ☐	
Check lubrication oil level (Fill if needed w/ Shell way oil)	☐ ☐ ☐ ☐	
heck filter for lubrication system (Whenever an overhaul is done)	☐ ☐ ☐ ☐	
Clean air filters for power distribution (Use simple green solution if needed) (Yearly procedure)	☐ ☐ ☐ ☐	
Clean carriage (use paint brush to remove chips, check for damage or excessive wear after each use)	☐ ☐ ☐ ☐	
Clean tool holder and way covers (Use paint brush) (After each use)	☐ ☐ ☐ ☐	
Clean off & around machine (Remove tools and objects off of machine, clean up any remaining chips, and wipe down viewing areas and machine to remove dust after every use)	☐ ☐ ☐ ☐	
Spindle access (Clean and remove any chips yearly)	☐ ☐ ☐ ☐	
Grease headstock feed support (When used or every year)	☐ ☐ ☐ ☐	
Calibration (Once a year and by instructor recommendations)	☐ ☐ ☐ ☐	
	☐ ☐ ☐ ☐	
	☐ ☐ ☐ ☐	

Dates Maintenance Performed:

Tong IL CNC Lathe

Machine Description

The Tong-IL TNL-20 CNC lathe is a gang type lathe with an 11 inch swing.

It is equipped with a Fanuc O-T series controller

It is currently equipped with a 5C collet type chuck but has the ability to accept a 3 jaw type chuck.

With the proper tooling it has the ability to machine any type of material.

It has a self contained coolant system.

It has automatic way and spindle oilers.

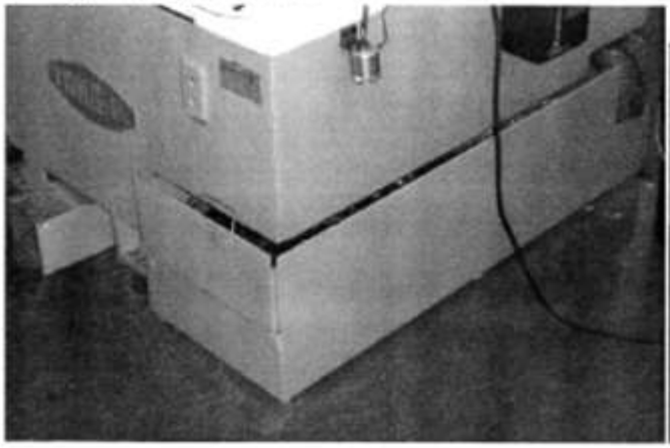
Maintenance

Fluid Checks

Hydraulic Fluid

Remove cap and visually check fluid if needed use a wooden dipstick. Add fluid when needed do not overfill.

Cutting Fluid / Coolant

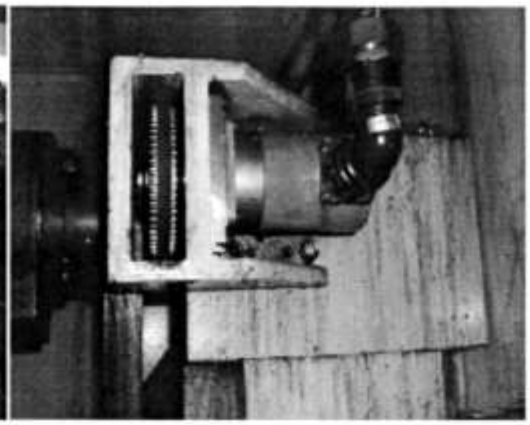


Remove top chip tray and visually check fluid. When replacing chip tray empty chips and remove any chips from fluid screen. Replace coolant every year or when needed.

Lubrication System Fluid

Check side gauge for adequate level of way oil add if in min range with shell way oil. Check way oil filter every major overhaul if needed replace filter.

Spindle Access Area



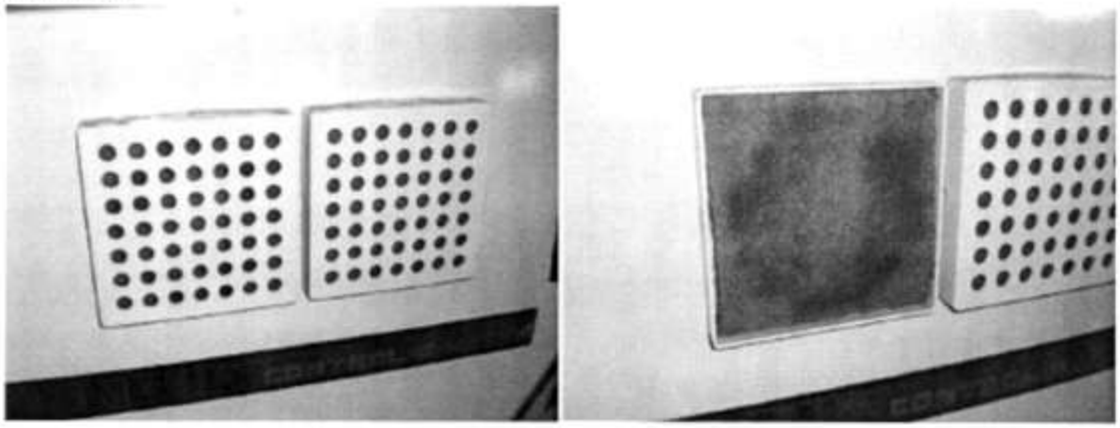
Remove spindle access panel and remove any chips and debris on a yearly basis.

Controller

Clean and wipe down Fanuc controller after each use or when needed.

For further maintenance to the controller, refer to the Fanuc controller manual.

Air filters



Clean the air filters on the back of the machine every 6 months. Wash them with simple green and water.

Additional Lubrication

Headstock Feed support

Grease the bearings with the grease zerk on yearly basis or when used.

E. Library Services

The Oregon Tech libraries has a local collection between our two campuses in Wilsonville and Klamath Falls of approximately 160,000 volumes of books and bound periodicals, over 5000 electronic books, and subscribes to over 3000 print and electronic serials. Among the electronic books are materials from ENGnetBASE and ASM Handbooks which specifically support programs in Mechanical Engineering and Manufacturing. Other online resources include over 70 databases and journal packages (including Engineering Village and Applied Science and Technology Full Text and ASME Digital Library Journals), federal and Oregon state documents, maps, and senior projects. All online resources are available through remote access via a proxy server to all Oregon Tech students and faculty, regardless of location. Reflecting nationwide trends, our print journals subscriptions have continued to decline over the last five years while access to electronic journals through direct subscriptions, consortial purchases, full-text databases, and open access journals has increased over the same period.

For items not owned or access directly through the Oregon Tech libraries, interlibrary loan services are available to students and staff without charge. Most requests for periodical articles are sent and received electronically, usually within three days. Book loans are also available through Summit, the regional consortium to which Oregon Tech belongs. Summit loans allow students to easily access materials from other engineering collections at 37 academic libraries in the Pacific Northwest and loans are delivered promptly by a regional courier service. Most loan requests may be made electronically from any location, without librarian mediation. Course reserve materials are listed in the online library catalog and are available in either print or electronic format.

In addition to Summit borrowing Oregon Tech students also have access to the Alliance Demand Driven Ebook Acquisition Program. There are currently 19,622 total titles available for patron loan; 1654 related to engineering in general, 115 in mechanical engineering and 54 in manufacturing. These shared ebooks are in addition to what is purchased locally by the Oregon Tech libraries and what is available in print through our Alliance partner libraries.

In July 2014, Oregon Tech will have an exciting new way for patrons to access information. All 37 libraries of the Orbis Cascade Alliance are migrating to a new Shared Integrated Library System (SILS) that encompasses all facets of library operations. With this groundbreaking move, the Alliance is doing something that other consortia have only considered. Each library will move from a discrete system on a local server to the new single, shared, cloud-based system. This next generation library system will allow for even deeper consortia cooperation and enhanced patron functionality.

Faculty may request the library to order books or subscriptions through our library faculty liaison program. Faculty librarians work closely with instructional faculty in their liaison area to determine the research needs of the department and to align purchases with those needs. Since FY 2011-12 funds allocated to the MMET. Dept. for one time purchases (typically books or videos) amounted to approximately $5400.

Subject liaison librarians create specialized subject guides for using information resources in each of the engineering disciplines which are available from the library’s web page. Instruction in using library and information resources is available on all campuses and has been integrated into several courses in the School of Engineering Technology and Management, from the freshman level to senior projects. Librarians are available for instruction services in all classes as well as for in-depth individual research consultations. Reference services are available to students and faculty, by appointment, by email, by telephone and on a drop-in basis.

As Oregon Tech has expanded its programs to distributed locations, the library has worked with faculty and the Distance Education Department staff to ensure that appropriate and adequate services are available to all Oregon Tech students. Library web pages specific to distance education students have been developed and are easily accessed from the library's main web page as well as through Blackboard. Library liaisons work with directors of programs offered at other sites (such as the Seattle campus) to assess local needs. The library has made it a goal to create more information literacy videos and tutorials to help address the needs of distance students for help in finding and using the materials available through the library. Also, the library has added chat reference to offer help to distance students along with our traditional contact methods of email and phone.

F. Overall Comments on Facilities

Klamath Falls Campus

In order to ensure that program facilities, tools and equipment are used safely and appropriately, the department chair and the lab manager conduct safety inspections of labs and equipment. In addition, safety lectures and guidelines are provided to students at the beginning of each lab course. MFG 120, a required course for ME students, includes comprehensive safety instruction for Mechanical Engineering students. At the institutional level, the Oregon Tech Risk Management Department oversees safety of all labs in all locations.

There are no extremely hazardous materials present in these labs. There is water and oil based coolants and machine oils present and basic metals. The MSDS sheets are available from the technician and also with campus safety. Fire extinguishers are present in many locations over the shop and multiple exits for evacuation. Chips and or dust is required to be cleaned up after parts are made as well as spills are to be cleaned up promptly. Closed top metal storage containers are used for dirty rags. The power and air for the machinery was designed and built into the ceiling of the building so there are no hoses, cords or extension cords draped across floor walkways.

Safe work practices are important to instill onto our fledgling students to carry with them to the companies that they leave to go work for. Safety is every ones priority and we hope that our engineers will keep their future employees and technicians safe too.

Seattle Campus

The additional space at the Everett location served to give the faculty and staff more office space and additional lab space to adequately support the program and activities associated with the programs. A new area has been organized for strengths of materials and mechanical experiments. Adjuncts can access the facilities and teach lab sections where the equipment is available. For students that need to take lower level hands-on type courses including machining and welding, the ability to complete those credits at a good local college is an advantage for the Seattle program and faculty who teach intermediate and advanced topics.

CRITERION 8. INSTITUTIONAL SUPPORT

A. Leadership

The academic leadership of the MMET Department is shown below in Figure 8.1. The MMET Department Chair is the leader for all undergraduate and graduate programs in the department, independent of their location. The MMET Department Chair reports to the Dean of the College of Engineering, Technology, and Management (ETM); and the Dean reports to the Provost. All full-time faculty members at all campuses report to the MMET Department Chair, who performs an annual performance evaluation for each of them.

The leadership responsibilities of the department are the primary duties of the department chair. The chair also serves as the department's interface to the institutional administration structure. The chair currently interfaces with other chairs in the College of Engineering, Technology and Management (ETM). The ETM College is under the leadership of the interim College Dean, Hallie Neupert. The department chairs of the two main colleges and other directors interface under an Academic Council Board that meets once a term and a school Academic Council that meets monthly with the Provost and Vice President for Academic Affairs. These meetings are chaired through the Provost's Office. This structure helps keep communication channels open and fosters an environment of shared governance and responsibilities.

The department chair has other responsibilities in the department outside of administration interfacing. The chair is responsible for budget development and allocation, personnel evaluations, staffing requests, faculty development, program enrollment management and leading assessment activities. The chair is given 0.5 FTE release time to handle these responsibilities and a stipend.

The three Bachelor of Science Degree Programs and the one Master's of Science degree program each have their own Program Director. The Program Directors are responsible for the curriculum of their program and coordinating assessment activities for their program across all three campuses.

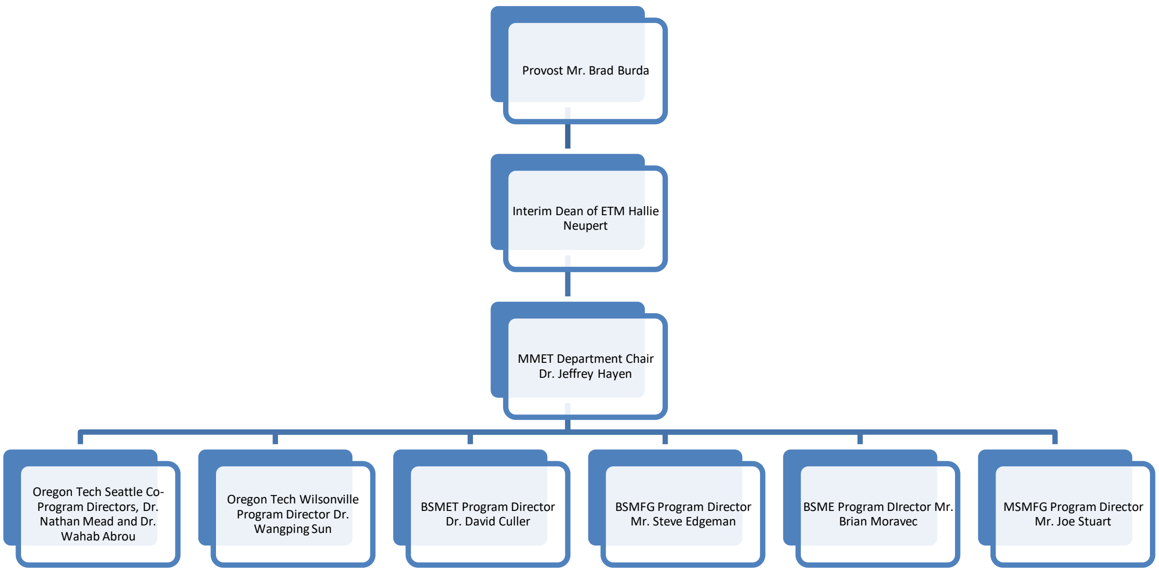


Figure 8.1 Academic Leadership of the MMET Department

In addition, at the Oregon Tech Seattle campus there is an MMET Program Director. The duties of the Seattle Program Director are to coordinate the delivery of the programs at the Seattle campus. This includes hiring and evaluating adjunct faculty members, At the Seattle campus Oregon Tech currently offers the BSMET, BSMFG, BSME, and MSMFG degree programs. Due to a recent departure, the Seattle Program Director duties are being shared by Dr. Nathan Mead and Dr. Wahab Abrous while a search is currently undergoing for a new Director.

Leadership responsibility for each program lies with the academic Program Directors, who are responsible for all curriculum and program decisions. If a decision or issue arises that affect multiple programs the MMET Department chair becomes involved to assure consistency with all programs within the department is maintained. However, in actuality, the academic Program Directors work closely with the Department Chair to guide the programs.

Day to day administration of the Seattle campus is carried out by the Site Program Directors. The curriculum is maintained for the branch campuses through the main campus by the academic Program Directors. Constant communication between the academic Program Directors, the Site Program Directors, and the Department Chair is required to make sure that the programs delivered are substantially equivalent.

To ensure consistency between the campuses, all course substitutions are approved by the MMET Department Chair. The MMET Department also holds a day-long faculty retreat before the start of fall term in which all full-time faculty from all campus meet to discuss the departmental goals for the upcoming year. As part of this meeting time is set aside for the faculty to discuss the course objectives for their individual course; this also helps to ensure that the courses are substantially equivalent.

Finally, during the later portion of spring term the MMET Department holds an end-of-year Assessment meeting. The faculty from all campuses meets as a group, with members joining the meeting either in person, via telephone, web conference, or via video conference. The main purposes of this meeting are to discuss the assessment activities for the past year, plan the assessment activities for the next year, and to close the loop on issues identified as part of our on-going assessment activities.

B. Program Budget and Financial Support

1. Part (a): Institutional and Program Budgets

Introduction

The OIT budget is assembled according to prescribed timelines by the Office of the Vice President for Finance and Administration under the direction of the President. The Financial Operations Advisory Council (FOAC) assists the administration by reviewing the budget and recommending financial actions to the President, including reallocations of the budget. The FOAC is comprised of administrators, faculty, and other staff members in order to ensure that all these institutional stakeholders have an opportunity for input to the budgetary process. This council also advises the President on the development of new budgetary initiatives; it is an integral element of institutional budgetary planning efforts.

At a designated time, the chairperson or director for each department forwards the budget worksheets to the appropriate vice president for review. The vice president then accepts or modifies the budget request of the department and submits it to the Budget Officer. The Budget Officer compiles the requests from all departments and distributes this information to the college deans and vice presidents for prioritization and further approvals.

Budgetary Process Timeline

Preliminary Remarks:

Until July 2015, OIT and six other public universities were members of the Oregon University System (OUS) and governed by the OUS Board of Higher Education. Since that time, OIT has been officially governed by the OIT Board of Trustees, and many of the academic policies and procedures formerly directed by the OUS Board of Education are now overseen by the Higher Education Coordinating Commission (HECC). Because of this relatively recent change, which is still in somewhat of a state of transition, certain details in the description provided below are historically expressed with the term ‘OUS’. After the new governing structure has been in place for an extended period of time and the new governance model has matured, all occurrences of the term ‘OUS’ will be removed from future self-study reports, and this term likely will be replaced with the phrase ‘Board of Trustees’.

The general process for budgeting and funding efforts can be summarized and described by the following sequence of activities and events occurring during the indicated months of an academic year:

- *October*

The FOAC meets to identify funding priorities that should be considered by the President as they relate to the institutional strategic plan. The FOAC receives an update on the status of the budget report.

- *December*

The Budget Office prepares two-year expenditure histories for each department to review and provides budget instructions and worksheets. This review allows past spending patterns to be recognized, identifies potentially necessary changes, and provides a basis for planning budgets for future years. New program requests, along with equipment and staff requests, are considered at this time.

- *January*

OUS provides an assessment of OIT current fiscal-year enrollment based upon actual Fall term full-time equivalent (FTE) figures and informs OIT of any adjustments that OUS will make to the budget based on under or over realized enrollment.

- *March*

Department budgets and new requests are submitted to the deans and vice presidents.

The Budget Office assists the departments, deans, and vice presidents in providing historical budget information and informs the deans, vice presidents, and President about anticipated course fee revenues and reallocations made by OUS.

The FOAC is informed about any significant changes to the OIT budget.

The Budget Office works with the appropriate dean or vice president to consider any budget changes and the accompanying economic impact upon the institution. A recommendation is then prepared for the President.

Service Departments, Auxiliary Enterprises, and other functional (non-instructional) units submit their budgets to their respective vice president.

- *April*

The vice presidents prepare a priority list for additions, reductions, or reassignments of funds within their areas of responsibility and complete other budgetary matters.

The Budget Office then prepares a draft budget with the approved changes, additions, and reductions for FOAC and Presidential review. Further recommendations may be offered by the FOAC to the President.

- *May*

The vice presidents meet with the President for budget finalization no later than May 31.

Budgets are loaded into the institutional accounting system (FIS) and made ready for the following fiscal year no later than June 15.

- *June*

Copies of the finalized budget are distributed throughout the institution as appropriate.

<u>New Faculty or Staff Members</u>
Requests for new faculty or staff members are handled though a separate process. Within each college, such requests are issued during the Fall term by department chairpersons to their dean for consideration. In a collaborative effort with the chairpersons, the dean forms a prioritized list for new positions within their college, which is subsequently submitted to the Provost. The Provost Leadership Team (PLT) then reviews the lists from both colleges (ETM and HAS) and makes the final decisions based upon available funding, current and projected program enrollments, and alignment with the institutional strategic plan. Any new positions must pertain to and support the institutional objectives and goals.

1. Part (b): Sources of Financial Support

Within OIT, there are many different types of funds that support and sustain the financial operations of the institution. The institutional fund of paramount importance to the MMET Department is the Educational & General Fund, which includes: appropriations from the State of Oregon, institutional income (tuition and fees), ETIC funds, lottery allocations, and indirect cost recovery on grants and contracts. The majority of the budgeted accounts for departments fall under this fund.

Expenditures for salaries and other payroll expenses are the responsibility of the Office of the Provost, since an institutional commitment of support is extended to the department whenever a faculty or staff member position is approved/created.

<u>Education & General Fund</u>
Each department is responsible for reconciling, on a monthly basis, its Services & Supplies (S&S), Student Pay, and Travel budgets and maintaining a positive balance in each account. Inquiry tools within the institutional accounting system are available to monitor the status of these budgets. The funding for these budgets originates from the Education & General Fund. The allocation for S&S constitutes the largest budget for an academic department, since it provides the funding needed to support the daily operations of the department.

Most of the direct funding for the daily operations of the MMET Department is supplied by budgets that originate from the Education & General Fund; see the Adequacy of Available

Resources subsection below.

Equipment Fund

The Equipment Fund (formerly known as the Engineering Fee Fund) started in the 2013-14 academic year. This fund serves as an internal resource to support and maintain the high-quality engineering and technology programs offered at OIT. Grants from this fund are obtained through a competitive proposal process, and they are intended for the periodic update and expansion of departmental equipment for programs, as well as occasional facility upgrades. This resource is managed by the Office of the Provost, which allocates an initial fund balance during the budgeting process for distribution to academic departments, the amount of which is announced at the beginning of the academic year. Each department submits a prioritized set of proposals for grants which are then evaluated for an award by the PLT.

Tables 8.1 and 8.2 displayed below indicate a representation of proposals submitted by the MMET Department which were funded over the last several years.

Table 8.1. PLT Equipment Fund Awards for 2013-14

Faculty Member	Description	Award Amount
Brian Moravec	Welding Laboratory Upgrade	$30,790
Steve Edgeman	Electromechanical Training System	$37,311
Wangping Sun	GD&T Laboratory Equipment	$15,000
Don Lee	Robotics Laboratory Equipment	$26,828
Steve Edgeman	Optical Comparator Instrument	$2,550

Table 8.2. PLT Equipment Fund Awards for 2014-15

Faculty Member	Description	Award Amount
Steve Edgeman	Electromechanical Training System	$38,125
Wangping Sun	Fluid Power Training Systems (2)	$40,934
Yanqing Gao	Lean Manufacturing Laboratory Equipment	$6,700

It should be mentioned that PLT Equipment Fund awards were suspended in the 2015-16 academic year due to the transition to a new strategic planning process by which future equipment-related expenses will be accommodated.

Resource Budget Commission

The Resource Budget Commission (formerly known as the Resource Fee Fund) started in the 1997-98 academic year. All full-time students at OIT are assessed a resource fee each term. These fees are accumulated in a fund managed by this commission, whose chairperson is the Vice President for Student Affairs. The funds are then utilized for projects, including equipment and services, that directly support OIT students.

Previously, faculty, staff members, and students could apply for grants from this fund through a competitive proposal process. Applications for grants are due in January of each year, and the proposal must address the intended purpose, grant amount requested, and expected outcomes/benefits of the project.

Since the 2013-14 academic year, the proportion of the RBC funds typically allocated each year to faculty projects was combined under the Equipment Fund. As a result, the RBC now only reviews and awards grants for student proposals, although identification of a faculty sponsor is required in most cases for these proposals.

Tables 8.3 through 8.7 displayed below indicate a representation of proposals submitted by the MMET Department which were funded over the last five years.

Table 8.3. RBC Grant Awards 2011-12

Department, Location	Description	Award Amount
MMET KF	Diesel Super-Mileage Vehicle	$1,970
MMET KF	GD&T Laboratory Enhancement	$1,405
MMET KF	Metallographic Microscope	$3,205
MMET KF	Sr. Project Formula SAE Vehicle	$15,265

Table 8.4. RBC Grant Awards 2012-13

Department, Location	Description	Award Amount
MMET KF	Sr. Project Formula SAE Vehicle	$17,340
MMET KF	Electromechanical Systems Simulation Software	$5,720
MMET KF	Laser Doppler Velocimeter	$10,000
MMET KF	Tools for Composites Laboratory	$2,562

Table 8.5. RBC Grant Awards 2013-14

Department, Location	Description	Award Amount
MMET KF	New Computers for MMET Student Design Center	$9,657
MMET KF	4th-Axis Capability for HAAS TM1-P Milling Center	$2,095
MMET KF	Sr. Project ASME RC Baja Vehicle	$2,400
MMET KF	Participation in FSAE West Competition	$5,051
MMET KF	Rapid Prototyping 3-D Printers	$4,876
MMET KF	Retrofit Kit for CNC Plasma Cutter	$5,229
MMET KF	Senior Design Project	$2,987
MMET KF	Sr. Project Funding for Parts Acquisition	$2,124
MMET WV	Torsion Testing Machine	$6,726

Table 8.6. RBC Grant Awards 2014-15

Department, Location	Description	Award Amount
MMET KF	Rapid Prototyping 3-D Printers	$3,510
MMET KF	Sr. Project Baja SAE Vehicle	$5,465
MMET KF	Coolant-Induced Holder for HAAS Mill	$1,500
MMET KF	Graduate Thesis Self-Heated Composite Tooling	$1,196
MMET KF	OIT UAS/UAV Project 2014	$2,505
MMET KF	Sr. Project Formula SAE Vehicle	$7,500
MMET WV	Industrial Controls Laboratory Equipment	$2,750
MMET WV	Torsion Testing Machine	$1,489

Table 8.7. RBC Grant Awards 2015-16

Department, Location	Description	Award Amount
MMET KF	Sr. Project Baja SAE Vehicle	$15,000
MMET KF	Sr. Project Formula SAE Vehicle	$14,134
MMET KF	Wind Power Lighting Group	$2,040

Special Course and Laboratory Fees

In addition to regular tuition, special fees are attached to some courses. These fees are posted in the Schedule of Classes published online for each academic term. The fees are predominantly utilized for the replacement of materials which may be consumed during laboratory activities, or the purchase of individual apparatus which will be retained by the students at the conclusion of the course. A list of courses from the BSME degree program for which such fees are assessed is indicated below in Tables 8.8, 8.9, and 8.10.

It should be mentioned that some MFG and MET courses are listed below because these courses are required in the curriculum for the BSME degree program. Also, only MMET courses with such fees which are required for this curriculum have been listed below.

Table 8.8. Special Fees Associated with Selected MFG Courses

Required Manufacturing Engineering Technology Courses with Fees	
MFG 103 Introduction to Welding Processes	$85.00/term
MFG 120 Manufacturing Processes I	$50.00/term

Table 8.9. Special Fees Associated with Selected MET Courses

Required Mechanical Engineering Technology Courses with Fees	
MET 160 Engineering Materials I	$50.00/term
MET 326 Electric Power Systems	$50.00/term

Table 8.10. Special Fees Associated with Selected ENGR/MECH Courses

Required Mechanical Engineering Courses with Fees

ENGR 213 Engineering Mechanics: Strength of Materials	$50.00/term
MECH 318 Fluid Mechanics I	$50.00/term
MECH 363 Engineering Instrumentation	$50.00/term
MECH 417 Fluid Mechanics II	$50.00/term
MECH 436 Classical Control Systems	$50.00/term
MECH 437 Heat Transfer II	$50.00/term
MECH 480 Mechanical Vibrations	$50.00/term
MECH 491 Senior Projects II	$50.00/term
MECH 492 Senior Projects III	$50.00/term

Engineering and Technology Differential Tuition

Tuition is assessed at an additional 15 percent for students enrolled in Engineering and Technology programs. This additional revenue supplies (in part) the Equipment Fund, and it also offsets the higher cost of offering and sustaining these programs due to factors such as equipment acquisition and maintenance, and it ensures market-value salaries for faculty.

Gifts, Grants, and Contracts

These funds originate from a variety of sources and are restricted to designated purposes. They can come from federal and state governments, foundations, individuals, companies, and non-profit organizations. They may be available for a few months or multiple fiscal years. Grant funds and budgets are managed by principal investigators in the department and the institutional grant accountant.

CCT Grant Awards and ETM College Dean Awards

The OIT Commission on College Teaching (CCT) is described in the next subsection. The CCT provides resources by which the MMET Department may be funded in order to fulfill its educational mission. In a manner similar to the process for the RBC, faculty are encouraged to submit applications for small grants that can directly benefit their instructional efforts or further their professional development. Table 8.11 below provides a summary of the total amounts of CCT grants awarded to the department by year.

Table 8.11. Total Amounts of CCT Grants Awarded

Academic Year	Total Amount of Awards
2010-11	$1600
2011-12	$2000
2012-13	$2341
2013-14	$1279
2014-15	$624
2015-16	$1099

Another important source of funds that supports and sustains departmental programs is funding available from discretionary budgets belonging to the ETM College Dean. This source is intended to assist in covering unplanned purchases or unanticipated expenses emerging at various times over the academic year. It is generally understood that this resource is not to be routinely relied upon but is intended for critical financial needs that suddenly and unexpectedly arise.

2. Institutional Support for Instructional Assistance

Attendance at teaching workshops and conferences is encouraged and supported by the OIT Commission on College Teaching (CCT). The CCT is charged with promoting teaching and learning, which in the most comprehensive sense includes any projects, studies, or activities that promote the learning climate, foster a spirit of critical inquiry in students and faculty alike, stimulate the intellectual life at OIT, or support the integration of the arts and sciences with the technologies embraced at OIT. The CCT organizes regular (often weekly) discussion group meetings and offers innovative teaching grants to support instructors in their efforts to improve their own teaching effectiveness and to participate in professional development opportunities.

It must also be mentioned that for the past two years, the institution increased the budget available to each faculty member for professional development from the historical amount of $500 to $1000. This amount can be elevated when, for a particular activity or event, the faculty member participates in a way that brings increased visibility to the institution.

The MMET Department has employed graduate teaching assistants for at least a decade to support instructional efforts; in particular, to cover certain laboratory sessions in order to relieve the workload needed to offer the undergraduate programs. In order to be eligible to serve in this capacity, these assistants must be enrolled as graduate students in the M.S. degree program in Manufacturing Engineering Technology. These assistants also perform other tasks such as grading undergraduate student assignments and facilitating faculty with their own applied research or the development/enhancement of laboratory activities.

The MMET Department occasionally hires undergraduate students to work as graders for lower-division courses (such as CAD for Mechanical Design I and II, or Strength of Materials). Typically, the department employs one student per term in this capacity. The department receives about $1500 in each of its two primary budgets (ME/MET and MFG) to pay for student workers over the entire academic year. The department strives to hire students who are ‘federal work-study’ eligible, as it can stretch those funds to last over many more hours of productivity due to the cost-reduction effect afforded by that federal program.

3. Infrastructure, Facilities, and Equipment Support

As described above, funds for the acquisition, maintenance, and upgrade of these elements are provided through a variety of resources.

It should be mentioned that OIT was recently awarded approximately 11 million dollars by the State of Oregon for a capital improvement project intended to support the engineering programs. This funding award will be applied toward the remodel of Cornett Hall, which houses the laboratories, machine and welding shops, and other project workspaces for the MMET Department, as well as some lesser facilities for some other departments.

4. Adequacy of Available Resources

Within the MMET Department, there is one budget for the Manufacturing Engineering Technology (MFG) program, and one combined budget for the Mechanical Engineering and Mechanical Engineering Technology (ME and MET) programs. At present, under the current accounting system, individual funding for the ME and MET programs is not separable from this combined budget. A number of the laboratories and associated equipment are shared between these programs, so this combination makes sense. The MFG budget is separate due only to historical agreements made when the MET and MFG departments were merged many years ago. The budgets for these programs over the last several years are indicated in Table 8.12 displayed below.

Table 8.12. General Fund Budgets for the MMET Department

Academic Year	ME/MET Budget	MFG Budget
2010-11	$20,440	$16,080
2011-12	$19,066	$16,141
2012-13	$18,206	$15,164
2013-14	$21,800	$14,367
2014-15	$28,893	$23,972
2015-16	$35,374	$18,250

As previously covered, other resources are available to support and sustain the financial needs of the MMET Department.

The MMET Department faculty and staff members remain vigilant in striving to obtain the finances and other resources needed for departmental operations in order to maintain the success of their degree programs. This success is rooted in ensuring that the students are able to attain the educational outcomes identified for them, and that the physical means are available for this objective.

It should be mentioned that OIT is an Oregon public university, so the OIT Seattle-Boeing programs (offered and physically located in the State of Washington) are required by law to be self-funded. No funds from the State of Oregon may be utilized to support and sustain these external programs. Also, through agreement with the State of Washington, these programs are only available to full-time employees of the Boeing Company (most of which work at the Commercial Airplanes assembly plants in Everett and Renton, WA).

In order to adequately support and sustain these external programs, OIT must charge a significantly higher tuition rate, which is agreed to and paid by the Boeing Company. This financial model allows OIT to provide this educational service yet be compensated for faculty, equipment and facilities, and administrative services. The higher tuition rate is periodically reviewed and re-negotiated to ensure that these programs are profitable.

C. Staffing

Support personnel for the MMET Department in Klamath Falls include one full time Laboratory Technician, and one part time administrative assistant. Our full time Laboratory Technician is Mr. Philip Dussel, and our Administrative Assistant is Ms. Barb Metcalf. Approximately 60% of our Administrative Assistant's, Ms. Barb Metcalf, time is dedicated to Project Lead the Way, 20% as MMET Department Administrative Assistant and 20% as office manager for Boivin Hall. Additional secretarial/clerical support is provided, as needed, by the team of General Instruction office managers located throughout the instructional offices.

Support personnel for the programs in Seattle including include a part time Laboratory Technician, and a Program Representative. The programs also get administrative support from various offices at the main campus in Klamath Falls. We feel that this is adequate for the programs there.

Oregon Tech offers ongoing training for its Administrative staff, including workshops for common computer applications. The Oregon Tech Risk Management Department also schedules training for staff in such applications as Safety, Fork Lift Operation, Highboy Operation, Crane Maintenance, etc.

Besides the resources described above, the Oregon Tech Klamath Falls campus provides a number of services to faculty and students. These include a full service library, career services, a financial aid office, student health center and a center for learning and teaching. Each is described briefly below. Note that similar functions are provided as well at the Seattle campus.

The library contains approximately 140,000 books and bound periodicals, and subscribes to over 1,200 periodicals. Resources and services include web-based catalog, over 70 online databases, federal and Oregon State documents, CD-ROMS, interlibrary loans, classes, tours, and seminars. Microform readers-printers and copy machines are available, as well as quiet study rooms on both the first and second floors. Over 40 computer workstations are available for public use.

Career Services supports student and alumni efforts to develop and achieve career goals. Services include: individual career advising; workshops and classroom presentations on resume writing, job interviewing, job search and applying to graduate school; on-campus employer recruitment, whereby companies and government agencies interview students for career and internship opportunities; Career Fairs, which bring employers and students together on campus to discuss career opportunities informally; career resource materials and job listings; and a resume referral service, which supports student applications for employment and graduate school.

The Student Financial Aid Office administers student aid in compliance with applicable law, regulations and policies that govern federal, state, institution, and private funds.

The Student Health Center provides affordable, quality health care for all students. It teaches students how to be educated health care consumers and promotes wellness.

The Center for Learning and Teaching (CFLAT) is a multi-purpose facility designed to enrich both learning and teaching at OIT. The center provides tutoring in several academic subjects, academic success classes, supplemental instruction support and coordination, and accommodations for students with disabilities, test proctoring, a computer laboratory, and the campus writing center. A media collection and video system used in conjunction with academic classes are also housed at the Center. In addition, CFLAT coordinates new student registration for the Klamath Falls campus, as well as new faculty orientation workshops, including the September Institute for New Faculty. It provides ongoing support for faculty to help improve teaching effectiveness and instructional skills.

D. Faculty Hiring and Retention

1. Process for hiring of new faculty.

Upon receiving preliminary approval from the College Dean to fill a vacant position or a new position, the academic department chair ("manager") will form the search committee and designate the search committee chair. The "Recruitment Request" form will be completed by the manager and forwarded to Human Resources for completion and submission for the indicated approvals. Approval by Executive Staff is required to initiate all searches.

It is the manager's responsibility to develop and document objective criteria for each job posting. The criteria (including education, experience, and essential skills, abilities and competencies) are to be used to screen applicants and aid in the selection process.

<u>The Search Committee</u>

The committee is usually no larger than five members. Human Resources (HR) will appoint an additional person as the Affirmative Action/Equal Opportunity (AA/EO) representative. The AA/EO representative is to be included in all meetings of the committee from formation through making the final hiring recommendation. With the exception of academic department chairs serving on faculty searches, the manager is not part of the search committee, which should operate as independently as possible in developing a ranking matrix and interview questions for assessing candidates.

The manager will meet with the committee to discuss the position, what is needed and desired in terms of candidate qualifications and attributes, how the position is expected to function in the department, and any other considerations. The manager may provide additional screening criteria, interview questions and other guidance at this time.

The AA/EO representative is to be included in all committee meetings and discussions throughout the search process, including the development of interview questions. The AA/EO rep will be given time at the first committee meeting to review Affirmative Action goals relevant to the position, as well as an overview of areas and means of prohibited inquiry and hiring considerations. The AA/EO rep or the HR Director should review interview questions in advance. The AA/EO rep or Human Resources Director will be available to discuss the recruitment and screening process, proper reference checking and, if applicable to the position background check procedures.

Students may serve on search committees and student input is valuable in assessing faculty and student services candidates. However, inclusion of students on search committees should be carefully considered given the nature of recruitment and interviewing; it is not uncommon that personal and professional information is shared within a search committee that must be closely guarded. We have found that the most complete and productive source of student input is through candidate presentations in the classroom or forum settings followed by a structured feedback process. Candidate meetings with small student groups are another means of getting a range of reaction and assessment of the candidate from a student perspective.

With the approval of the appropriate Vice President, non-employees such as advisory board members and Oregon Tech consultants with relevant expertise may sit on search committees. They will be required to follow the search procedures and protocols and avoid creation of liability for Oregon Tech in their participation in the search.

Human Resources will create a specific search folder on the Oregon Tech common "T" Drive, within the "HR Searches" folder for each search. Individual candidate application folders will be entered into the search folder. All members of the committee and the manager will be granted access to that file. However, student and non-employee members of the search committee will not be provided with this access; they will be provided printed copies of application materials that have had home addresses, phone numbers and other protected information redacted; they will not be provided names of references and shall not be permitted to make reference contacts. The search chair will coordinate creation of these redacted materials with Human Resources.

Human Resources will notify search committee members of their access to the search folder by email, and committee members are responsible for periodically checking the file for new applications.

Phone Interviews and Campus Visits

The manager can sit in on phone/video interviews, and will identify themselves as such, while stating that they are there as an observer; they will participate only if the candidate asks a question that committee members don't have information about, such as departmental budgeting, institutional structure, etc. If the manager is not present, the search chair should respond to candidate questions that cannot be answered at that time that the information will be obtained and passed on to them.

Permission should be secured at the start of the phone interview to tape record the call for any committee member who is absent.

Permission to check references should be gained at the close of the phone interview and inform the candidate that HR will forward a permission form for their signature. The candidate should be told they can request that any reference or current supervisor not be contacted at that time, but if the candidate is to be offered the position, the current supervisor will be contacted prior to the offer.

The committee will make recommendations regarding those candidates that should be considered further, including invitations for on-campus interviews, and the chair will share this with the manager. It will be the manager's decision as to who will be invited, and may override the committee's recommendations.

The committee will submit a summary of the finalists to the manager; the preferred submission would be an alphabetized list of the finalists citing strengths and weaknesses of each. The search committee will not rank or specifically recommend candidates unless requested to do so by the manager. The department head will request the Vice President's approval to proceed with campus visit invitation(s).

For on-campus interviews, the manager will not sit in on committee interviews. The manager will hold a separate, individual interview with the candidate. The manager is free to attend open forums, presentations and class sessions candidates might hold during the on-campus visit. The visit itinerary will include a visit with the HR Benefits Officer to provide the candidate relevant information.

Following the campus visit, the search chair will provide the manager with a summary of the committee's findings and recommendations, including any input from campus presentations and meetings.

The manager, in consultation with their supervisor, as appropriate, will make the final decision on who will be offered the position and proceed with securing approvals for the offer and hire as shown on the "Hiring Recommendation" form.

The search committee chair is responsible for completing the "Reasons for Non-selection" form, citing reasons for each unsuccessful candidate. This form includes a list of typical reasons that can be used. The assigned Affirmative Action representative or Human Resources staff can assist with this.

Salary Discussions and Offers of Employment

The search chair and department chair should discuss the possible salary range with the Provost in advance of the search committee deliberations. All postings for faculty positions will contain the statement "salary will be commensurate with education and experience. Oregon Tech's faculty compensation is competitive with our comparator institutions." A range will be available to share with the candidates but the search chair will inform them that salary negotiations are conducted by the Provost only. The Human Resources Director, as administrator of the collective bargaining agreement, will make classified position offers and negotiate salary.

Search Records

At the close of the search, all notes, printed materials, interview tape or digital recordings, and committee minutes (if used) will be forwarded to the Human Resources Office. These materials, including handwritten notes on resumes and elsewhere, are subject to records retention law and are discoverable in the event of civil rights or other legal challenge to the search. The Human Resources Office will maintain archived search records until they are to be destroyed in keeping with the law.

2. Strategies used to retain current qualified faculty.

New faculty members all go through an organized, annual orientation before the start of fall term called September Institute; the purpose is to introduce new faculty members to campus organizations and activities. September Institute presents information on personnel matters, administrative operations, and major events of the academic calendar, teaching, and classroom management.

Conducted by faculty and staff members, the informal sessions give valuable information regarding Oregon Tech policies and procedures and encourage discussion of issues such as grading practices, consulting, and committee assignments. New faculty members have an opportunity to meet key personnel and to be briefed on issues of major concern to the campus.

All new faculty members at the Klamath Falls campus go through a term-long, organized course on advisor training during winter term of their first year; faculty in Wilsonville and Seattle go through similar training in a compressed mode. The training includes good advising guidelines, familiarity with the Oregon Tech policies and procedures associated with advising, familiarity with the departmental curriculum and practice advising sessions under the guidance of an experienced departmental faculty member.

Each new faculty member in the MMET Department works with a mentor during their first year; note that this is in place at all three campuses. The reason for having each new faculty member work with a mentor for their first year (and sometimes more) are many and include: help with preparing course objectives and syllabi, help with running labs, help with understanding and following all of the Oregon Tech policies and procedures, and to help the new faculty member feel connected to the MMET Department.

The Commission on College Teaching (CCT) is charged with promoting teaching and learning, which in the most comprehensive sense includes any projects, studies or activities that promote the learning climate, foster a spirit of critical inquiry in students and faculty alike, stimulate the intellectual life at OIT, or support the integration of the arts and sciences with the technologies at OIT.

The responsibilities of the Commission on College Teaching are: 1) to foster and promote sound instructional practices on campus; 2) to promote innovative instructional techniques among the faculty; 3) to evaluate the staff career support program, Media Center, and Learning Center grant applications and make recommendations to the Provost on these and related activities pertaining to the improvement of college teaching; and 4) to serve as a resource to faculty members in the improvement of their teaching. The Commission is comprised of the Director of the Center for Learning and Teaching or designee; a Dean; seven faculty members, one faculty member to represent Portland operations, and two students.

E. Support of Faculty Professional Development

Support for faculty development comes from several sources. Each faculty is allocated $1000 a year from the departmental budget. Other professional development funding sources are competitive and aimed towards a particular activity. These sources include the Oregon Renewable Energy Center, the Dean's Office, the Provost's Office, the Commission of College Teaching, and externally funded grants to name a few. Due to the variety of sources it is not possible to track professional development funding through the OIT budgeting process. A survey of faculty within the department shows an annual average per faculty member on the order of $2000.

A faculty member is normally eligible to request a sabbatical leave after accumulating six or more full-time years of service. Part-time service of half-time or more may also count in accumulating time toward sabbatical. Individuals with part-time appointments or those whose appointments have included a mixture should read the state board's rules on eligibility for sabbatical leave set forth in OAR 580-21-0200 through OAR 580-21-0240. The text of the rules is set forth on the back of the Oregon Tech sabbatical leave application form. If you have questions about your eligibility for sabbatical leave, check with the staff in the Provost's Office.

Academic Affairs has been charged with monitoring the sabbatical leave program and can help faculty with questions about the program and its requirements.

Sabbatical leave is a paid period of release time designed to reinvigorate and restore one's academic energies, and to provide a base for future intellectual development and achievement. During the leave period, a faculty member may receive between 60 and 85 percent of salary depending on the length of the leave and the school, university, or other administrative affiliation. Sabbatical leave is not a right of employment, nor is it a reward for excellent performance and services rendered. Sabbatical leave is a privilege awarded, based upon an assessment of the contribution that will be made to the university as a result of the leave. If the work to be conducted while on leave will strengthen the eligible faculty member's ability to serve the mission and purpose of the university in the future, a teaching faculty member's application for sabbatical leave will usually be approved.

Many faculty members are affiliated with various professional organizations, reflecting the individual's commitment to continuing education and standards of practice. In the engineering certification and/or licensure may be requirements for occupational recognition and the right to practice. Since technical expertise and field experience are considered essential for Oregon Tech faculty, the pursuit and maintenance of professional credentials are encouraged. Attendance at conferences, workshops, pursuit of additional degrees or certificates, and other activities that increase the expertise of the faculty are supported by the university and incorporated into the annual performance evaluation. Oregon Tech is not able, however, to pay membership or licensure fees.

Oregon Tech encourages and expects publication and presentation of scholarly materials and information. Depending on the level of expertise and the nature of the academic discipline, faculty should share professional skills, educational methodology, research data, inventions, artistic endeavors, and other products of academic activities in local, regional, national, and international arenas. Faculty may request financial support and release time from his/her department chair and the provost (as appropriate) to attend conferences and participate in academic pursuits

Faculty have several opportunities for on-campus professional development during the year. Special workshops and presentations are regularly given in the fall during the first week that faculty are back on campus. These include such topics as assessment, learning styles, legal issues, diversity, etc. Attendance at these presentations is generally required.

Several times during the year, special guest lecturers give presentations. Usually these are discipline-specific and sponsored by individual departments, student clubs, or the university as a whole. Faculty members are asked to acquaint their students with these opportunities and to participate as well.

Summer productivity grants are awarded by the provost when funding is available. Faculty members submit proposals to department chairs; the proposals are prioritized by the department chair and sent to the dean. The dean, in collaboration with the provost, allocates grants based on priority, merit, and availability of funds. Summer productivity grants are usually awarded to fund special projects, maintain laboratory and shop equipment, develop innovative teaching strategies, or pursue relevant academic interests.

CRITERION 9. PROGRAM CRITERIA

PROGRAM CRITERIA FOR MECHANICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: American Society of Mechanical Engineers

From the ABET criteria:

> “These program criteria will apply to all engineering programs that include "mechanical" or similar modifiers in their titles. 1. Curriculum The curriculum must require students to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations); to model, analyze, design, and realize physical systems, components or processes; and prepare students to work professionally in either thermal or mechanical systems while requiring topics in each area. 2. Faculty The program must demonstrate that faculty members responsible for the upper-level professional program are maintaining currency in their specialty area.”

Mechanical Engineering specific outcomes are addressed through the program's assessment process. Two student learning objectives have been added to ABET's *a* through *k* outcomes, m1 and m2, which are assessed on a 3-year cycle along with outcomes *a* through *k*.

Figure 6.3 shows the professional development activates of the faculty members responsible for the upper-level professional program.

APPENDICES

Appendix A – Course Syllabi

The syllabi of the course required for the BSME degree at Oregon Tech are shown below. The syllabi are grouped similar to the areas shown on Table 5.1; and are shown in the following order:

- Math/Science
- Engineering Topics
- Selected Mechanical Engineering Electives
- General Education (Required courses only)
- Other

Math/Science Syllabi

Oregon Institute of Technology

College of Health, Arts, and Sciences
Department of Natural Sciences

CHE 201/204: General Chemistry I

Catalogue Description (2011–2012):	Atomic and molecular structure, chemical bonding, chemical and physical properties, introduction to stoichiometry and thermochemistry are presented.
Hours/Credits: (Lecture-Lab-Total)	CHE201: (3-0-3) CHE204: (0-3-1)
Class Schedule:	Three 50-minute lectures/week, one ten week term
Lab Schedule:	Once-weekly 170-minute labs, one ten week term
Prerequisites:	High school chemistry or CHE101 equivalent.
Required Text:	Brown, Lemay, Bursten, Murphy & Woodward. "Chemistry: The Central Science" 12^{th} ed. Pearson Prentice Hall, 2011.
Reference Text:	None
Course Coordinator:	Elvira Schechtel
Regular Instructors:	Seth Anthony, Elvira Schechtel
Course Objectives:	Upon completion of the course, a student should be able to: • perform scientific calculations applying appropriate SI units, significant figures, and dimensional analysis; • describe and apply relationships between atomic and molecular structure, chemical symbols, and basic chemical properties (e.g. mass, charge, quantity); • perform basic stoichiometric calculations using balanced chemical equations; describe common types chemical and physical transformations of matter on the molecular-level; • describe the molecular-level behavior of substances in aqueous solution; be able

	to use molarity to describe and quantify concentration; • understand and apply kinetic-molecular theory to relate molecular-level behavior of gases to physical properties; • apply basic thermochemical relationships and perform basic thermochemical calculations.		
Topics Covered:	• Metric system and dimensional analysis • Atomic structure • Stoichiometry • Chemical and physical changes • Common classes of chemical reactions • Ideal gas law and kinetic-molecular theory of gases • Thermochemistry		
Relevant Program Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering (b) an ability to design and conduct experiments, as well as to analyze and interpret data		
Required or Elective:	Required		
Criterion 5:	Physical and Natural Sciences		
Prepared By:	Seth Anthony	Updated:	April 25, 2014

College of Health, Arts, and Sciences
Department of Natural Sciences

CHE 202/205: General Chemistry II

Catalogue Description (2011–2012):	A continuation of CHE201. This course discusses the behavior of gases, liquids, and solids, the properties of solutions, chemical kinetics, and an introduction to equilibrium.
Hours/Credits: (Lecture-Lab-Total)	CHE202: (3-0-3) CHE205: (0-3-1)
Class Schedule:	Three 50-minute lectures/week, one ten week term
Lab Schedule:	Once-weekly 170-minute labs, one ten week term
Prerequisites:	CHE 201 and CHE 204
Required Text:	Brown, Lemay, Bursten, Murphy & Woodward. "Chemistry: The Central Science" 12th ed. Pearson Prentice Hall, 2008.
Reference Text:	None
Course Coordinator:	Elvira Schechtel
Regular Instructors:	Seth Anthony, Elvira Schechtel
Course Objectives:	Upon completion of the course, a student should be able to: • describe and calculate relationships between physical properties of photons; • relate quantum numbers to atomic orbital designations, shapes, and energies; write electron configurations for monatomic species; • describe different types of chemical bonding; • apply basic periodic trends and understand their relationships to electron configurations and geometries; • draw Lewis structures for molecular species and use Lewis structures to predict molecular shape, polarity, and applicable intermolecular forces; • relate intermolecular forces to macroscopic properties such as phase changes, vapor pressure, and solubility; • describe basic mechanisms for chemical reactions and their conceptual relationships with reaction rates and dynamic equilibria.
Topics Covered:	• Quantum theory and atomic structure • Periodic trends in atomic properties • Covalent bonding, Lewis structures and molecular shape • Intermolecular forces • Aqueous solutions • Chemical kinetics and equilibrium
Relevant Program Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering (b) an ability to design and conduct experiments, as well as to analyze and interpret data
Required or Elective:	Required
Criterion 5:	Physical and Natural Sciences
Prepared By:	Seth Anthony Updated: April 25, 2014

College of Health, Arts and Sciences
Department of Mathematics
MATH 251: Differential Calculus

Catalog Description (2015/2016):	Theory, computational techniques and applications of the derivative.
Hours/Credits: (Lecture-Lab-Total)	(4-0-4)
Class Schedule:	Four hours of lecture per week
Prerequisites:	Math 112 Trigonometry with grade "C" or better
Required Text and other supplemental materials:	Briggs, Cochran, Gillet. *Calculus, Early Transcendentals*. 2nd Ed., 2015
Regular Instructors or Course Coordinator:	Tiernan Fogarty
Course Objectives:	Upon completion of the course, students should be able to: • Compute limits, both graphical and computational. • Explain what the concept of a derivative is. • Derive the definition of the derivative. • Compute derivatives. • Solve applied problems including related rates and optimization. • Communicate mathematical ideas using correct and appropriate notation.

Topics Covered:	• Limits and the concept of continuity.
	  ○ Limits: graphical, algebraic, and numerical
	  ○ Continuity at a point and on an interval
	• The definition of the derivative: limit of the slope of the secant line, instantaneous rate of change
	• Derivatives.
	  ○ Derivatives of polynomial and trigonometric functions
	  ○ Product, quotient, and chain rules
	  ○ Implicit differentiation, including inverse trigonometric functions
	  ○ Derivatives of exponential and logarithmic functions
	• Application of derivatives to:
	  ○ Function behavior

	○ Rectilinear motion ○ Related rates ○ Optimization		
Relevant Student Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering. (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.		
Required or Elective:	Required		
Criterion 5:	Math & Basic Science		
Prepared By:	David Hammond	Updated:	02/12/2016

College of Humanities, Arts and Science
Department of Mathematics
Math 252 Integral Calculus

Catalogue Description	Computational techniques for and applications of the definite and indefinite integrals.
Hours/Credits: (Lecture-Lab-Total)	(4-0-4)
Class Schedule:	Four hours of lecture each week
Prerequisites:	MATH 251 with grade "C" or better.
Textbook:	*Calculus: Early Transcendentals*. Briggs, Cochran and Gillett. 2nd Edition. Pearson.
Regular Instructors:	Terri Torres
Course Objectives:	• Evaluate indefinite and definite integrals. • Use definite integrals to solve application problems. • Use various integration techniques to evaluate integrals. • Communicate mathematical ideas using correct and appropriate notation.
Topics Covered:	1. Apply mathematical concepts and principles to perform computations. Core Criteria: (a) Compute the anti-derivative of a basic form (linear combinations of x_n for any rational n, sin x, cos x and e^x without use of formulas or a calculator. (b) Compute an anti-derivative like those in (a) but which requires a step of algebraic manipulation prior to integration. (c) Compute an anti-derivative using u-substitution. (d) Compute an anti-derivative using integration by parts, given the integration by parts formula (e) Compute an anti-derivative using partial fractions, for a quadratic denominator without repeated linear factors. (f) Compute an anti-derivative requiring one substitution with a trigonometric identity. g) Transform an integral containing one of the forms $a^2+x^2, a^2-x^2, x^2-a^2$ or the square root of any of those into trigonometric form, given the right triangle trigonometric definitions of the trig functions. (h) Determine a method that could be successfully used to compute an anti-derivative. (i) Solve an initial value problem. 2. Understand the theory of definite integrals. Core Criteria:

	(a) Approximate a definite integral using a finite sum of areas of rectangles. (b) Use a graph to determine the value of a definite integral. Additional Criteria: (c) Apply properties of definite integrals to evaluate integrals of arbitrary functions with given definite integrals. (d) Express a definite integral as a limit of sums or vice-versa. (e) Compute a definite integral using a limit of sums. (f) Use the Fundamental Theorem of Calculus to differentiate an integral of the form $\int_a^x f(t)dt$. 3. Compute definite integrals; use definite integrals to solve applied problems. Core Criteria: (a) Use the Fundamental Theorem of Calculus to evaluate a definite integral. (b) Use a definite integral to find the area between two curves. (c) Set up an integral representing the volume of a solid of revolution about a coordinate axis, given the formulas for solids of revolution. (d) Set up an integral representing the length of a curve, given the formula. (e) Set up an integral representing an amount of work or a hydrostatic pressure. Additional Criteria: (f) Use *u*-substitution to change the variable of integration in a definite integral, including changing the limits of integration. (g) Evaluate an improper integral of the form $\int_a^\infty f\left(x\right)dx$ (h) Approximate the solution of an applied problem from given data values using some sort of numerical integration. (i) For an integral expression representing a physical quantity, give the units of any part of the expression, including the entire integral. (j) Set up an integral representing the area of a surface of revolution, given the formula. (k) Find the average value of a function in the context of an application. (l) Compute the distance traveled and displacement between two times from a velocity function in equation form. Additional Criteria: (e) Use the graph of the derivative of a function to graph the original function.
Required or Elective:	Required
Criterion 5:	Math and Basic Sciences
Prepared By:	Terri Torres Updated: 01/20/2016

College of Health, Arts and Sciences
Department of Mathematics
MATH 254N: Vector Calculus I

Catalogue Description (2015/2016):	Vectors, vector functions, and curves in two or three dimensions. Surfaces, partial derivatives, gradients and directional derivatives. Multiple integrals using rectangular and other coordinate systems. Physical and geometric applications.
Hours/Credits: (Lecture-Lab-Total)	(4-0-4)
Class Schedule:	Four hours of lecture per week
Prerequisites:	MATH 252 with grade "C" or better.
Required Text and other supplemental materials:	Briggs, Cochran, Gillet. *Calculus, Early Transcendentals,* 2nd Ed., 2015
Regular Instructors or Course Coordinator:	Tiernan Fogarty
Course Objectives:	Upon completion of the course, students should be able to: • Compute vectors in two and three-space, lines and planes in three-space. • Find vector-valued functions of one variable and compute their derivatives. • Find functions of two and three variables and compute their derivatives. • Perform multi-dimensional integration. • Communicate mathematical ideas using correct and appropriate notation.
Topics Covered:	• Multidimensional coordinates ○ Parametric and vector equations ○ Rectangular, cylindrical, spherical coordinates ○ Lines and curves ○ Planes and surfaces • Vectors and vector operations ○ Vector addition and multiplication ○ Dot product, projections ○ Cross product • Vector functions and space curves ○ Derivatives and integrals of vector functions

	◦ Arc length and curvature ◦ Velocity acceleration and speed ◦ Tangential and normal components of acceleration • Functions of several variables ◦ Partial derivatives including higher order and mixed derivatives ◦ Chain rule ◦ Directional derivatives and gradient vectors ◦ Extrema and 2nd partial test • Multiple integrals • Rectangular and general regions • Double and triple integrals. • Double integrals in polar coordinates
Relevant Student Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering. (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
Required or Elective:	Required
Criterion 5:	Math & Basic Science
Prepared By:	David Hammond — Updated: 02/12/2016

College of Health, Arts and Sciences
Department of Mathematics
MATH 321: Applied Differential Equations I

Catalog Description (2015/2016):	The first in a two term sequence on the solutions of ordinary differential equations. Introduction to differential equations, first and second order equations with applications.
Hours/Credits: (Lecture-Lab-Total)	(4-0-4)
Class Schedule:	Four hours of lecture per week
Prerequisites:	MATH 252 with grade “C” or better.
Required Text::	Zill, Dennis G., *A First Course in Differential Equations with Modeling Applications*, 9th Ed., 2009
Regular Instructors or Course Coordinator:	Tiernan Fogarty
Course Objectives:	Upon completion of the course, students should be able to: • Classify and solve first and second order differential equations and initial value problems. • Model physical phenomena with first and second order differential equations. • Solve applied problems in the context of first and second order differential equations. • Communicate mathematical ideas using correct and appropriate notation.
Topics Covered:	• Classification of Differential Equations • Methods of Solving ODE’s e.g. Separation of Variables, Integrating Factor • Initial and Boundary Value Problems • Mathematical Modeling with ODE’s • Applications may include Spring/Mass Systems, RLC Circuits, Beam Equations
Relevant Student Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering. (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
Required or Elective:	Required
Criterion 5:	Math & Basic Science
Prepared By:	David Hammond — Updated: 02/12/2016

College of Health, Arts and Sciences
Department of Applied Mathematics
MATH 341: Linear Algebra I

Catalog Description (2015–2016):	The study of vectors and matrices in Euclidean space, their geometric interpretations and application to system of equations. Includes linear independence of vectors, basis and dimension, introduction to linear transformations, eigenvalues and eigenvectors, diagonalization, determinants.
Hours/Credits: (Lecture-Lab-Total)	(4-0-4)
Class Schedule:	Four hours of lecture each week
Lab Schedule:	None
Prerequisites:	MATH 252 with grade "C" or better
Textbook:	*Linear Algebra with Applications,* J. Holt, Freeman & Company.
Regular Instructors:	Dibyajyoti Deb
Course Objectives:	Upon completion of the course, a student should be able to: • Solve systems of equations. • Understand vectors and their algebra in R^n. • Understand the relationship of vectors to systems of equations. • Understand matrices and perform matrix algebra. • Use matrices to solve systems of equations. • Understand subspaces and their bases. • Understand and use linear transformations. • Understand eigenvalues and eigenspaces, diagonalization.
Topics Covered:	• Lines and Linear Equations • Linear Systems and Matrices • Applications of Linear Systems • Vectors • Span • Linear Independence • Linear Transformations • Inverses • LU Factorization • Introduction to Subspaces • Basis and Dimension • Row and Column Spaces • The Determinant Function • Eigenvalues and Eigenvectors • Diagonalization

Relevant Student Outcomes:	(a) An ability to solve systems of linear equations (b) An ability to perform vector and matrix operations. (c) An ability to understand Euclidean vector spaces and linear transformations. (d) An ability understand and use eigenvalues and eigenvectors. (e) An ability to model and solve matrix system applications.		
Required or Elective:	BSMATH: Required Math Minor: Required		
Criterion 5:	Math & Basic Sciences		
Prepared By:	Dibyajyoti Deb	Updated:	1/23/2016

College of Health, Arts and Sciences
Department of Mathematics
MATH 361: Statistical Methods I

Catalog Description (2015/2016):	Descriptive statistics, experimental design, introduction to probability, common probability distributions, random variables, sampling distributions, hypothesis testing and confidence intervals for means using one and two samples, simple linear regression.
Hours/Credits: (Lecture-Lab-Total)	(4-0-4)
Class Schedule:	Four hours of lecture per week
Prerequisites:	MATH 111 or instructor's consent
Required Texts and other supplemental materials	Sullivan. *Fundamentals of Statistics*. Pearson/Prentice Hall, 2nd Edition.
Regular Instructors or Course Coordinator:	Terri Torres
Course Objectives:	Upon completion of the course, students should be able to: • Organize and describe data with numerical measures. • Organize and describe data graphically. • Compare multiple graphs for different data sets. • Describe data with appropriate vocabulary. • Calculate and interpret probabilities with discrete and continuous distributions. • Make inferences about population mean(s).
Topics Covered:	• Graphical presentation of data: histograms and stemplots. Skewness. • Descriptive statistics: mean, median, variance standard deviation, standard scores, range, quartiles, and interquartile range. • Correlation and regression. • Probability overview: empirical. • Probability rules of addition and multiplication; to include conditional. • Binomial distribution. • Central Limit Theorem and its relationship to sample means and sample proportions. • Estimation with error: means, and proportions. • Hypothesis testing overview: general scientific structure. • Test of mean: large sample and small sample.

	• Test of two means		
Relevant Program Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering. (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.		
Required or Elective:	Required		
Criterion 5:	Math & Basic Science		
Prepared By:	Aaron Scher	Updated:	2/15/2016

College of Engineering, Technology and Management
Department of Mathematics
MATH 451: Introduction to Numerical Methods

Catalogue Description (2013–2014):	Computer applications of matrix methods, iterative solutions of equations, and systems of equations, polynomial interpolation and curve fitting, numerical differentiation and integration.
Hours/Credits: (Lecture-Lab-Total)	4 credits / 4 contact hours
Class Schedule:	Four hours of lecture each week
Lab Schedule:	
Prerequisites:	Prerequisites: MATH 252 and MATH 341 or MATH 261 and programming language.
Textbook:	*An introduction to numerical Methods A MATLAB Approach* by Abdelwahab Kharab and Ronald B. Guenther, Third Edition, 2112.
Regular Instructors:	Dr. Tiernan Fogarty
Course Objectives:	Upon completion of the course, a student should be able to: • Solve nonlinear equations with numerical methods. • Use numerical methods for curve fitting and approximation. • Perform numerical differentiation and integration of functions. • Solve systems of equations with numerical methods. • Write and interpret basic programming.
Topics Covered:	• Matrix methods • Iterative solutions of equations • Polynomial interpolation • Curve fitting • Numerical differentiation • Integration
Relevant Program Outcomes:	(a) An ability to solve nonlinear equations with numerical methods. (b) An ability to perform numerical differentiation and integration of functions. (c) An ability to solve systems of equations with numerical methods. (d) An ability to write and interpret basic programming.
Required or Elective:	Required
Criterion 5:	Math and Basic Science
Prepared By:	Dr. Tiernan Fogarty — Updated: 05/24/2016

College of Health, Arts and Sciences
Department of Mathematics
MATH 465: Mathematical Statistics

Catalogue Description (2015/2016):	Counting techniques, probability, discrete and continuous random variables and distribution functions, joint probability distributions; expected value, variance and covariance; decision making.
Hours/Credits: (Lecture-Lab-Total)	(4-0-4)
Class Schedule:	4 hours of lecture per week
Prerequisites:	MATH 254N
Required Texts and other supplemental materials	An introduction to Mathematical Statistics and its Applications, Richard Larsen, 5th ed.
Regular Instructors or Course Coordinator:	David Hammond Greg Waterman
Course Objectives:	Upon completion of the course, students should be able to: • Apply counting principles • Solve classical probability problems • Use general, special, and joint distributions to solve problems
Topics Covered:	• Sample spaces and the probability function • Applications of Bayes' rule • Combinatorics and combinatorial probability • Discrete and continuous random variables and distribution functions • Joint probability distributions • Expected value, variance, and covariance • Binomial, hypergeometric, exponential, normal, Poisson and geometric distributions
Relevant Program Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering. (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
Required or Elective:	BSEE: Required BSREE: Elective
Criterion 5:	Math & Basic Science
Prepared By:	David Hammond — Updated: 2/15/2016

College of Health, Arts, and Sciences
Department of Natural Sciences
PHY 221: General Physics with Calculus

Catalog Description (2015–2016):	Basic principles of physics with emphasis on applications of calculus. Newtonian mechanics, including kinematics, dynamics, work, energy, power, and hydraulics. All general physics students must register for a laboratory section.
Hours/Credits: (Lecture-Lab-Total)	(3-3-4)
Class Schedule:	3 hours per week
Lab Schedule:	3 hours per week
Prerequisites:	MATH 251 with grade "C" or better.
Corequisites:	MATH 252
Required Text:	1. Young and Freedman, *University Physics,* 13th Ed., Addison Wesley, 2012. 2. Oregon Institute of Technology, *Physics I Lab Instructions/Worksheets* (provided to students)
Reference Text:	None
Course Coordinator:	Dr. Robyn Wilde
Regular Instructors:	Matt Beekman, PhD; Robyn Wilde, PhD; Lisa Taylor, MS
Course Objectives:	Upon completion of the course, a student should be able to: • perform scientific calculations applying appropriate SI units, significant figures, and dimensional analysis • proficiently develop and use coordinate systems and appropriate vector mathematics for solving physical problems • quantitatively and qualitatively analyze motion using the concepts of position, velocity, and acceleration • identify and apply appropriate physical principles for problem solving in Newtonian mechanics • understand and apply Newton's Laws to solve problems quantitatively and qualitatively • understand and apply energy and momentum conservation laws to solve problems quantitatively and qualitatively • use physical intuition and conceptual understanding to make qualitative predictions in physical situations • use and apply differential and integral calculus to physical problem problems • solve algebraic problems symbolically • show proficiency in basic skills used in experimental data

	collection and quantitative analysis, including appropriate use of uncertainties		
Topics Covered:	• Vectors and vector operations • Kinematics (motion in 1-, 2-, and 3-dimensions under constant acceleration) • Newton's Laws; forces and motion • Work, kinetic energy, potential energy, conservation of energy, Power • Impulse and momentum, conservation of momentum • Rotational motion, moment of inertia, and torque (time permitting) • Fluids (static and dynamic; time permitting) • Data collection and analysis; experimental uncertainty (lab)		
Relevant Student Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering. (b) an ability to design and conduct experiments, as well as to analyze and interpret data. (e) an ability to identify, formulate, and solve engineering problems. (g) an ability to communicate effectively. (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.		
Required or Elective:	Required		
Criterion 5:	Math & Basic Science		
Prepared By:	Lisa Taylor	Updated:	2/12/2016

Oregon TECH

College of Health, Arts, and Sciences
Department of Natural Sciences
PHY 222: General Physics with Calculus

Catalog Description (2015–2016):	Temperature systems, heat, kinetic theory of gasses, thermodynamics and the fundamentals of electricity and magnetism. All general physics students must register for a laboratory section.
Hours/Credits: (Lecture-Lab-Total)	(3-3-4)
Class Schedule:	3 hours per week
Lab Schedule:	3 hours per week
Prerequisites:	PHY 221; MATH 252
Required Text:	1. Young and Freedman, *University Physics*, 13th Ed., Addison Wesley, 2012. 2. Oregon Institute of Technology, *Physics II Lab Instructions/Worksheets* (provided to students)
Reference Text:	None
Course Coordinator:	Dr. Robyn Wilde
Regular Instructors:	Matt Beekman, PhD; Robyn Wilde, PhD; Lisa Taylor, MS
Course Objectives:	Upon completion of the course, a student should be able to: • perform scientific calculations applying appropriate SI units, significant figures, and dimensional analysis • proficiently develop and use coordinate systems and appropriate vector mathematics for solving physical problems • apply basic concepts and the laws of thermodynamics to solve quantitative and qualitative physical problems • understand and apply fundamental laws of electricity and magnetism to solve quantitative and qualitative physical problems • quantitatively and qualitatively analyze multi-loop DC electrical circuits containing voltage sources, resistors, and capacitors • use and apply differential calculus to physical problems • use physical intuition and conceptual understanding to make qualitative predictions in physical situations • solve algebraic problems symbolically • show proficiency in basic skills used in experimental data collection and quantitative analysis, including appropriate use of uncertainties

Topics Covered:	• Universal Gravitation • Temperature, heat, thermal properties of matter • Heat, work, and the 0^{th}, 1^{st} and 2^{nd} laws of thermodynamics; simple heat engines and refrigerators • Electric charge, Coulomb's law, electric fields, electric potential and potential energy • Electric current, capacitance, resistance and Ohm's law, Kirchoff's laws in basic multi-loop DC circuits • Magnetic fields and sources, Lens's law, inductance • Data collection and analysis; experimental uncertainty (lab)		
Relevant Student Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering. (b) an ability to design and conduct experiments, as well as to analyze and interpret data. (e) an ability to identify, formulate, and solve engineering problems. (g) an ability to communicate effectively. (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.		
Required or Elective:	Required		
Criterion 5:	Math & Basic Science		
Prepared By:	Lisa Taylor	Updated:	2/12/2016

Oregon TECH

College of Health, Arts, and Sciences
Department of Natural Sciences
PHY 223: General Physics with Calculus

Catalog Description (2015–2016):	Wave motion, sound, introduction to geometrical and physical optics, and selected topics from modern physics. All general physics students must register for a laboratory section.
Hours/Credits: (Lecture-Lab-Total)	(3-3-4)
Class Schedule:	3 hours per week
Lab Schedule:	3 hours per week
Prerequisites:	PHY 222
Required Text:	1. Young and Freedman, *University Physics*, 13th Ed., Addison Wesley, 2012. 2. Oregon Institute of Technology, *Physics III Lab Instructions/Worksheets* (provided to students)
Reference Text:	None
Course Coordinator:	Dr. Robyn Wilde
Regular Instructors:	Matt Beekman, PhD; Robyn Wilde, PhD; Lisa Taylor, MS
Course Objectives:	Upon completion of the course, a student should be able to: • perform scientific calculations applying appropriate SI units, significant figures, and dimensional analysis • identify, and quantitatively and qualitatively analyze physical situations involving simple harmonic motion and mechanical waves • apply the tools of geometrical optics (ray diagrams, lens and mirror equations, etc.) to analyze image formation by mirrors and lenses • solve quantitative and qualitative problems involving refraction and reflection of light and image formations • solve quantitative and qualitative problems involving the interference of sound and the interference of electromagnetic waves • apply differential and integral calculus to physical problems • solve algebraic problems symbolically • show proficiency in basic skills used in experimental data collection and quantitative analysis, including appropriate use of uncertainties

Topics Covered:	• Oscillating systems, simple harmonic motion, resonance • Traveling and standing mechanical waves, including waves on strings and sound waves; Doppler effect; wave interference; sound intensity • Electromagnetic waves; polarization • Basic geometrical optics, including reflection, refraction (Snell's law), and images formed by mirrors and lenses • Basic physical optics, including coherence, double-slit and single-slit interference of light, diffraction gratings, X-ray diffraction • Basic concepts from modern physics, including quantum theory and special relativity (time permitting) • Data collection and analysis; experimental uncertainty (lab)		
Relevant Student Outcomes:	(a) an ability to apply knowledge of mathematics, science, and engineering. (b) an ability to design and conduct experiments, as well as to analyze and interpret data. (e) an ability to identify, formulate, and solve engineering problems. (g) an ability to communicate effectively. (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.		
Required or Elective:	Required		
Criterion 5:	Math & Basic Science		
Prepared By:	Lisa Taylor	Updated:	2/12/2016

Engineering Topics

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

ENGR 111 – *MMET Orientation*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Topics include: survey of the engineering profession, educational and professional development, standards of practice, engineering information, calculations, and analysis. An engineering design project will be incorporated. This course provides knowledge and skills to engineering students which will benefit their future academic and professional endeavors.

PREREQUISITES:

Declared major in the BSME, BSMET, or BSMFG programs.

TEXTBOOK:

So You Want to be an Engineer? – What to Learn · What to Expect,
1/E (Floyd & Spencer), Industrial Press, 2015.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Knowledge of elements of the historical perspective, traditional disciplines, typical activities, and career opportunities associated with the engineering profession.
- Understanding of the importance of educational and professional development, as well as standards of practice, in relation to the engineering profession.
- Knowledge of the essential aspects of (and procedures for) engineering calculations.
- Understanding of the significance and usefulness of engineering models.
- Ability to formulate and solve simple engineering problems.
- Ability to interpret and communicate results of solutions to engineering problems.
- Awareness of the ethical responsibilities associated with developing and applying new technologies.

- Understanding of the importance to maintain or exceed expected professional standards.

TOPICS COVERED:

- Overview and Curricula for the MMET Programs
- Strategies for Success in Engineering Programs
- Survey of the Engineering Profession
- Engineering, Technology, and Creativity
- Strategies to Improve Time Management
- Educational and Professional Development
- Standards of Practice
- Engineering Information
- Engineering Calculations
- Engineering Analysis
- Engineering Teamwork and Communication
- Brief Introduction to Engineering Software

SCHEDULE:

Lectures: One 50-minute lecture per week over a 10-week academic term.
Laboratory: One 3-hour lab. Session per week over a 10-week academic term.
Credits: Two quarter-based term credits (1-3-2).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to function on multidisciplinary teams (d).
- Graduates should be able to identify, formulate, and solve engineering problems. (e).
- Graduates should have an understanding of professional and ethical responsibility (f).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

ENGR211 *Statics*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
Fundamental principles of mechanics of rigid bodies and the application of these principles to engineering problems.

PREREQUISITES:
MATH 252. Integral Calculus.
PHY 221 (or PHY 201) General Physics

TEXTBOOK:
Required:
ENGINEERING MECHANICS, STATICS,
13th edition, R.C. Hibbeler, Pearson

COURSE LEARNING OUTCOMES:
Upon completion of this course students should be able to:

1. To use both conceptual and numerical techniques to solve engineering problems.
2. To understand and use the general ideas of force vectors.
3. To understand and use the general idea of equilibrium of a particle.
4. To understand and use the general ideas of force system resultants.
5. To understand and use the general ideas of equilibrium of a rigid body.
6. To understand and use the general ideas of structural analysis.
7. To understand and use the general ideas of internal forces and friction.
8. To understand and use the general ideas of center of gravity, centroids, and moments of inertia.

TOPICS COVERED:
- General principles. Force vector.
- Equilibrium of a particle
- Force system resultant
- Equilibrium of a rigid body
- Structural analysis – Trusses
- Structural analysis – Frame
- Internal forces
- Shear force and bending moment diagrams

- Friction
- Center of gravity and centroid
- Moment of inertia

SCHEDULE:

Four 50 minute lectures/week over a 10 week term

Credits: Four quarter-based term credits (4-0-4)

PROGRAM OUTCOMES:

This courses contributes to the following ABET-EAC Program Outcomes,

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should be able to identify, formulate, and solve engineering problems. (e).
- Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

PREPARER:

Yanqing Gao
Dept. of MMET
04/19/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

ENGR 212 – *Engineering Mechanics: Dynamics*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
Kinematics of particles and rigid bodies. Kinetics of particles and rigid bodies confined to planar motion. Analyses by Newton's second law of motion, the work-energy principle, and the impulse-momentum principle.

PREREQUISITES:
ENGR 211 – Engineering Mechanics: Statics
MATH 252 – Integral Calculus

TEXTBOOK:
Engineering Mechanics: Dynamics, 13/E (Hibbeler), Prentice Hall, 2012.

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Understand the distinctions between Kinematics and Kinetics.
- Ability to apply Newtonian Principles to solve dynamics problems.
- Ability to apply Work-Energy Principles to solve dynamics problems.
- Ability to apply Impulse-Momentum Principles to solve dynamics problems.
- Understand the significance of Translation and Rotation in rigid-body motion.
- Understand the concept of Mass Moment of Inertia for rigid-body motion.
- Ability to recognize and solve problems with Constrained Motion of rigid bodies.
- Ability to combine Kinematic and Kinetic Relations to solve dynamics problems.
- Interpret and communicate results of solutions to engineering problems.

TOPICS COVERED:
- Particle Kinematics (The Description and Geometry of Motion)
- Particle Kinetics:
  - Newton's Second Law of Motion
  - Work-Energy Principles
  - Impulse-Momentum Principles
- Systems of Particles: An Approach to Rigid Bodies

- Rigid-Body Kinematics (Translation and Rotation)
- Rigid-Body Kinetics:
  - Newtonian Principles
  - Work-Energy Principles
  - Impulse-Momentum Principles

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

ENGR 213 – *Engineering Mechanics: Strength of Materials*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Internal stresses and deformations of structural members and machines when subjected to external forces.

PREREQUISITES:

ENGR 211 - Statics

TEXTBOOK:

Mechanics of Materials, 9/E, 2013 R.C. Hibbeler, Prentice Hall,
ISBN-13: 978-0133254426

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Describe the importance of material properties as they apply to strength of materials.
- Determine internal forces, stresses, and deformations in axially loaded members.
- Determine torsion stresses and strains in circular shafts. Determine angles of twist in constant diameter and non-uniform shafts.
- Determine shear force and bending moment expressions and plot the associated diagrams for concentrated, constant and linearly distributed loading conditions.
- Determine the plane, principal, and maximum shear stresses for beams.
- Determine the stresses in spherical and/or cylindrical thin walled pressure vessels.
- Determine the stresses in combined loading problems involving combinations of axial loading, shaft torsion, beam bending and shear loads.
- Determine principal stresses, maximum shear stress and the stress state at am arbitrary angle of rotation for any given two dimensional stress state.
- Determine allowable column buckling loads using Euler’s Method and the Secant Method.
- Calculate forces, then prepare shear force and bending moment equations and diagrams.
- Formulate beam bending equations using the double integration method.
- Design simple structural elements (beams and columns) based on flexure, shear and deflection controls.

TOPICS COVERED:

- Normal stresses and strains
- Elasticity, plasticity, creep, Poisson's ratio
- Shear stress and strain, bending stresses, design for allowable loads
- Displacement of axially loaded members, statically determinate structures
- Thermal Effects
- Torsion, angle of twist, internal torque and deformation
- Shear force and bending moment
- Bending and shear stresses in beams
- Plane stresses, principle stresses, and maximum shear stresses.
- Mohr's circle
- Combined Stresses
- Pressure Vessels
- Column buckling

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term.
Lab: One 3-hour lab per week over a 10-week academic term.
Credits: Four quarter-based term credits (3-3-4).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should be able to identify, formulate, and solve engineering problems. (e)

PREPARER:

Irina Demeshko
Associate Professor, MMET Department
September 14, 2015

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

ENGR 236 – *Fundamentals of Electric Circuits*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Resistive circuits, operational amplifiers, capacitors, inductors, transient analysis, sine waves, AC circuits analysis, resonance, transformers. Not for Electronics Engineering Technology and Computer Engineering Technology students.

PREREQUISITES:

MATH 251 – Differential Calculus
PHY 222/202 – General Physics with Calculus

TEXTBOOK:

Electric Circuits, 10/E (Nilsson & Riedel), Prentice Hall, 2015.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Understanding of the Distinction between Analog versus Digital Signals
- Understanding of the Concepts of Charge Carriers and Drift Velocity
- Ability to Represent Simple Electrical Systems by Circuit Models
- Ability to Apply the Standard Methods of Analysis to DC Circuits
- Understanding of Circuit Transformation and Equivalence Concepts
- Ability to Apply the Standard Methods of Analysis to AC Circuits

TOPICS COVERED:

- Circuit Variables and Elements
- Circuit Elements and Principles
- Elementary Resistive Circuits:
  - Series/Parallel Element Combinations
  - $\Delta \rightarrow Y$ and $Y \rightarrow \Delta$ Transformations
- Standard Methods of Circuit Analysis:
  - The Node-Voltage (N-V) Method
  - The Mesh-Current (M-C) Method
  - Source and Other Transformations
  - Thévenin and Norton Equivalents

- Inductors and Capacitors
- Sinusoidal Steady-State Circuits: Analysis Methods
- Sinusoidal Steady-State Circuits: Power Calculations

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

CRITERION MET:

[This section to be completed by program directors for each degree program.]

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

ENGR 266 – *Engineering Computation*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Programming and problem solving using current computer software. General programming techniques using conditional statements, looping, subroutines, and data input/output will be stressed. Consideration of features specific to the software being used will also be presented.

PREREQUISITES:

MATH 111 – College Algebra

TEXTBOOK:

Introduction to VBA for EXCEL®, 2/E (Chapra), Prentice Hall, 2010.
MATLAB®: An Introduction with Applications, 4/E (Gilat), Wiley, 2011.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Ability to Create Programmed Solutions to Engineering Problems
- Ability to Assemble Spreadsheets and Create Macros
- Ability to Apply Structured Programming Methods/Techniques
- Ability to Apply Modular Programming Methods/Techniques
- Ability to Apply Some Basic Numerical Analysis Algorithms

TOPICS COVERED:

- Concepts and Principles of Computation
- Computational Language Fundamentals
- Macros: Subroutines and Functions
- Graphical Displays (2-D)
- Procedures: Scripts and Functions
- Elementary Decision Structures
- Classical Algorithms
- Numerical Analysis

SCHEDULE:

Lectures: Two 50-minute lectures per week over a 10-week academic term.

Laboratory: One 3-hour lab. Session per week over a 10-week academic term.
Credits: Three quarter-based term credits (2-3-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).
- Graduates should have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY

Manufacturing and Mechanical Engineering and Technology

ENGR 355 *Thermodynamics I*

SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

This course is an introduction to the basic concepts of energy conversion, including the first and second laws of Thermodynamics. The course includes properties and state, energy, work, heat, entropy, and system analysis. The course focuses on a detailed study on the application of these thermodynamic fundaments to energy conversion systems.

PREREQUISITES:

MATH 252. Integral Calculus.
PHY 222 (or PHY 202) General Physics

TEXTBOOK:

Required:
Fundamentals of Engineering Thermodynamics
7th edition, Moran, Wiley

COURSE LEARNING OUTCOMES:

Upon completion of this course students should be able to:

1. Appreciate the utility of the general engineering problem-solving method.
2. Apply basic concepts, energy-related terminology and concepts, units, and dimensions.
3. Apply concepts related to systems, properties and states, including heat, energy and work.
4. Make computations involving special forms of work and energy.
5. Detailed analysis – The First Law of Thermodynamics.
6. Detailed analysis – The Second Law of Thermodynamics.
7. Applications to Systems and Cycles.

TOPICS COVERED:

Systems and Behavior
Engineering Dimensional Analysis
Energy and First Law of Thermodynamics
Thermodynamic Property Relationships
Ideal Gas Model and Properties
Energy Analysis of Control Volumes
Second Law of Thermodynamics
Entropy Property and Engineering Application

SCHEDULE:

Three 50 minute lectures/week over a 10 week term
Credits: Three quarter-based term credits (3-0-3)

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- an ability to identify, formulate, and solve engineering problems (e)
- Graduates will be able to work professionally in the area of thermal systems (m1)

PREPARER:

Josh T Millard
Dept. of MMET
05/17/2016

OREGON INSTITUTE OF TECHNOLOGY
Department of Management

ENGR 445 Project Management
SYLLABUS

REQUIRED/ELECTIVE FOR:

Elective: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Application of the Critical Path Method to organization and control project implementation. Applications software will be used to create and evaluate project networks and to develop management reports.

PREREQUISITES:

Junior Standing in Engineering or Engineering Technology

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TEXTBOOK:

1. *Project Management In Practice*, Meredith/Shafer/Mantel/Sutton; Wiley, Fifth Edition
2. Microsoft Project Software – available on campus or at onthehub:
   https://e5.onthehub.com/WebStore/ProductsByMajorVersionList.aspx?cmi_cs=1&cmi_mnuMain=bdba23cf-e05e-e011-971f-0030487d8897&ws=b8d00114-d69b-e011-969d-0030487d8897&vsro=8

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Describe key characteristics and requirements of successful project management
- Apply key aspects of project management including: planning, scheduling, resource allocation, monitoring and control, evaluation and termination
- Use common features and functionality of project management software
- Be conversant in the language of project

TOPICS COVERED:

- The World of Project Management
- The Manager, The Organization, and the Team
- Project Activity and Risk Planning
- Budgeting the Project
- Scheduling the Project
- Allocating Resources to the Project
- Allocating Resources to the Project
- Monitoring and Controlling the Project
- Evaluating and Terminating the Project

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term; this varies per student project selected.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates will have the ability to function on multidisciplinary teams (d)

PREPARER:

Brian Moravec
Professor, MMET Department
05/14/2016

OREGON INSTITUTE OF TECHNOLOGY
Mechanical and Manufacturing Engineering and Technology

MECH 313 – Thermodynamics II
SYLLABUS

REQUIRED FOR:
Bachelor of Science in Mechanical Engineering

DESCRIPTION:
Application of laws and principles of thermodynamics to real thermodynamic cycles. Teaches analysis of performance and design of internal and external combustion engines, steam generators, heat pumps, compressors, and refrigeration machinery.

PREREQUISITES: ENGR 355 – Thermodynamics

TEXTBOOK: Moran, M.J. and Shapiro, H.N., Fundamentals of Engineering Thermodynamics, 7th Edition, John Wiley and Sons, Inc., 2008.
ISBN: 13 978-0470-49590-2 or 13 978-0470-91768-8

COURSE LEARNING OUTCOMES/ TOPICS COVERED:
Upon Completion the student will:
- Perform energy analysis of ideal and real systems including Rankine, Brayton, Otto, Diesel and Dual power cycles
- Perform energy analysis of Refrigeration cycles including Rankine and Brayton
- Evaluate Maxwell relations
- Perform Vander-Waals, Z, and Redlich Kwan evaluations
- Do molar and mass mixture analysis
- Calculate energy transfer and adiabatic Flame temperature calculations including excess and deficient air

:SCHEDULE:
Lectures: Three 50-minute lecture per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:
This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have the ability to communicate effectively. (g)
- Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

PREPARER:

Sean Sloan
Assistant Professor, MMET Department
6/8/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 315 – *Machine Design I*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
Study of stress and fatigue analysis as applied to machine elements.

PREREQUISITES:
ENGR 213 – Engineering Mechanics: Strength of Materials

TEXTBOOK:
Fundamentals of Machine Component Design, 5/E (Juvinall & Marshek), Wiley, 2012.

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Ability to Determine Stresses in Machine Elements
- Ability to Perform Static Stress Analyses
- Ability to Perform Fatigue Stress Analyses
- Ability to Analyze and Design Belt and Chain Drives
- Ability to Analyze and Design Shafts (for Transmission of Power)

TOPICS COVERED:
- Nature of Mechanical Design
- Materials in Mechanical Design
- Stress and Deformation (Review)
- Possible Supplemental Topics:
  - Stresses in Curved Beams
  - Buckling of Columns
- Combined Stresses; Mohr's Circle
- Kinds of Loading; Failure; Fatigue
- Keys, Fasteners, Couplings, Seals
- Tolerances and Fits
- Belts and Chains
- Shafts

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an understanding of professional and ethical responsibility (f).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 316 – *Machine Design II*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Application of stress and fatigue analysis in the design and selection of machine elements.

PREREQUISITES:

MECH 315 – Machine Design I

TEXTBOOK:

Fundamentals of Machine Component Design, 5/E (Juvinall & Marshek), Wiley, 2012.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Ability to Analyze and Design Spur Gears
- Ability to Determine Stresses in Spur Gears
- Ability to Select/Specify Appropriate Bearings
- Ability to Analyze and Design Power Screws
- Ability to Select/Specify Threaded Fasteners
- Ability to Determine Stresses in Threaded Fasteners
- Ability to Select/Specify Bolted and Welded Connections*
- Ability to Analyze and Design Elastic Springs
- Ability to Analyze Clutches, Brakes, and Flywheels*

TOPICS COVERED:

- Kinematics/Kinetics of Gears
- Analysis/Design of Spur Gears
- Helical Gears, Bevel Gears, and Worm Gears/Screws*
- Rolling Contact Bearings
- Plain Surface Bearings
- Power Screws
- Threaded Fasteners
- Bolted and Welded Connections*

- Elastic Springs
- Clutches, Brakes, and Flywheels*

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an understanding of professional and ethical responsibility (f).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY
Mechanical and Manufacturing Engineering and Technology

MECH 318 – Fluid Mechanics I
SYLLABUS

REQUIRED FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
Covers fluid properties, fluid statics, conservation laws of pipe flow, drag, lift, fluid dynamics, measurement of flow, viscous flow, laminar, and turbulent flow, and forces due to fluid motion.

PREREQUISITES: ENGR 211 – Statics
PHYS 221 - Kinematics

TEXTBOOK: Fluid Mechanics, 3rd Edition, Cengal and Cimbala, McGraw Hill, 2014.
ISBN#:978-0-07-338032-2

COURSE LEARNING OUTCOMES/ TOPICS COVERED:
Upon Completion the student will:

- Model Fluid Behavior,
- Make pressure calculations using manometers and windows
- Do density calculations including wet weight and dry weight
- Implement the Bernoulli equation to solve flow problems along streamlines,
- Use Reynolds number calculations in boundary layers and friction,
- Compare thixotropic and shear thinning material behavior
- Differentiate between Laminar and Turbulent flows,
- Make pipe flow calculation using the Moody chart,
- Evaluate pump head curves and Net Positive Suction Head,
- Calculate drag and lift with power requirements

:SCHEDULE:
Lectures: Three 50-minute lecture per week over a 10-week academic term.
Lab: One 3-hour lab per week over a 10-week academic term.
Credits: Four quarter-based term credits (3-3-4).

PROGRAM OUTCOMES:
This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have the ability to communicate effectively. (g)
- Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

PREPARER:

Sean Sloan
Assistant Professor, MMET Department
6/8/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 323 – *Heat Transfer I*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

An introduction to the three modes of heat transfer: conduction, convection, and radiation. Teaches the analytical and empirical techniques used for solving problems in heat transfer, including those for which computer application is most suited.

PREREQUISITES:

MATH 321 – Applied Differential Equations I
MECH 318 – Fluid Mechanics I

TEXTBOOK:

Introduction to Heat Transfer, 6/E (Incropera & DeWitt), Wiley, 2011.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Understand the distinctions between the three modes of heat transfer.
- Ability to apply the heat-diffusion equation to conduction problems.
- Ability to solve steady-state conduction problems.
- Ability to solve transient conduction problems.
- Ability to assess boundary-layer effects for laminar and turbulent flows.
- Ability to solve natural (“free”) convection problems.
- Understand the theory for radiation heat transfer.
- Ability to evaluate radiant energy exchange between black/gray surfaces.
- Interpret and communicate results of solutions to engineering problems.

TOPICS COVERED:

- Description of the Modes of Heat Transfer
- Introduction to Conduction Heat Transfer
- Steady-State Conduction
- Transient Conduction
- Introduction to Convection Heat Transfer
- Forced External Convection

- Forced Internal Convection
- Natural (“Free”) Convection
- Introduction to Radiation Heat Transfer
- Radiant Energy Exchange

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY

School of Engineering, Technology and Management

Mechanical and Manufacturing Engineering and Technology

MECH 351 Finite Element Analysis
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Mechanical Engineering

DESCRIPTION:
This course is an introduction to the use of finite element analysis (FEA) in the solution of mechanical engineering problems. Existing FEA computer codes are used.

PREREQUISITES:
MET 375 Solid Modeling
MECH 315 Machine Design

TEXTBOOK:
Introduction to Finite Element Analysis using Creo, Shih, SDC Publications

COURSE LEARNING OUTCOMES:
Upon completion of this course students should be able to:
- Be familiar with the terminology used in Finite Element Analysis.
- Identify the significant benefits of using Finite Element Analysis as a design tool.
- Produce accurate and adequate engineering models using Pro/Engineer and pro/Mechanica.
- Perform the necessary FEA analysis of 1D, 2D and 3D structural problems using Pro/Engineer and pro/Mechanica.
- Apply the modeling techniques taught to develop, and refine designs.
- Apply the software taught to problems in follow-on courses.

TOPICS COVERED:
- Introduction
  - History of Finite Element Analysis
  - Modeling considerations
  - Finite Element Analysis Procedure
- The Direct Stiffness method
  - Modeling Fundamentals
  - Spring Element
  - Transformation Matrix
- Truss elements
  - One-dimensional Trusses
  - Two-dimensional Trusses
  - Three-dimensional Trusses
- Beam Elements

- Beams
- Statically Indeterminate structures
- Shear and Moment diagrams
- Combined Loading

2-D solid Elements
- Plane Stress
- 2-D Solids

3-D Solid Elements
- 3-D solids

Shell Elements
- Pressure Vessel analysis

Frequency analysis
- Straight beam Modal analysis

SCHEDULE:

2 - 50 minute lectures/week over a 10 week term
3 term credits (3-2-3)

PROGRAM OUTCOMES:

This course contributes to the following Program Outcomes. These outcomes align with the EAC a-k outcomes.

c. Graduates should be able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
e. Graduates should be able to identify, formulate, and solve engineering problems.
g. Graduates should have the ability to communicate effectively.
k. Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice.
M2. Graduates will be able to work professionally in the area of mechanical systems.

PREPARER:

Randy Shih
Professor, MMET
March 5, 2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 360 – *Materials II*
SYLLABUS

REQUIRED FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
The course extends the MET 160 Engineering Materials I course using a more theoretical approach. Subjects include metals, polymers, ceramics, and composites.

PREREQUISITES:
MET 160 and CHE 201 or CHE 221

TEXTBOOK:
Materials Science and Engineering an Introduction, 9th edition, William D. Callister, Jr. (required)

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Gain theoretical and practical experience in modern engineering materials.
- Understand ferrous metals and metallurgy; composites, polymers and ceramics and study the relationship of material structure to the material properties.
- Become familiar with the major classes of materials
- Gain knowledge of the common measurement of material properties among various classes of materials
- Improve engineering communication skills through researching, writing, speaking and giving technical presentations
- Understand the principles of ‘sustainable’ and ‘socially responsible’ engineering as it applies to material selection and processing and how this affects human life, our planet and the environment.
- Understand ‘life cycle analysis’ and ‘life cost considerations’ in the selection of materials for engineering design.
- Gain training that will help the student to effectively select materials in the design process.

TOPICS COVERED:

- Structures and properties of ceramics
- Applications and processing of ceramics
- Polymer structures
- Characteristics, Applications and processing of polymers.
- Composite materials properties and characteristics
- Corrosion and degradation of materials

- Electrical properties of materials
- Thermal properties of materials
- Magnetic properties of materials
- Optical properties of materials
- Economic, Environmental and Societal Issues in materials science.

SCHEDULE:

Lectures: Two 75-minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should be able to identify, analyze and solve technical problems (e).
- Graduates should have the ability to communicate effectively (g).

PREPARER:

Joe Stuart
Associate Professor, MMET Department
12/06/2015

OREGON INSTITUTE OF TECHNOLOGY

Mechanical and Manufacturing Engineering and Technology

MECH 363 Instrumentation

REQUIRED/ELECTIVE FOR:

Required - Bachelor of Science, Mechanical Engineering

DESCRIPTION:

Study of measurement techniques and equipment used in mechanical engineering. Instrumentation for measurement in mechanics, thermodynamics, fluid dynamics, and electrical systems are considered. Methods of calibration, correction, and data reduction are presented.

PREREQUISITES (or CO-REQUISITES):

ENGR 213 (Engr Mech: Strength of Materials), PHY 222 General Physics with Calculus
ENGR 236 Fundamentals of Electric Circuits (or Co-requisite)

TEXTBOOK:

1. *Experimental Methods for Engineers, J. P. Holman, 8th Ed., McGraw-Hill*
2. *Theory and Design for Mechanical Measurements, 6th ed, R. Figliola, Wiley*
3. *Handouts from a couple of texts, chapters, papers, or technical reports*

COURSE LEARNING OUTCOMES:

Upon completion of this course students should be able to:

- Perform engineering experiments with instruments and measurement systems
- Understand the appropriate level of theories and design in the areas of mechanical engineering for experimental measurements and methods as a mechanical engineer
- Analyze, specify and collect data from measurement systems for mechanical and electrical quantities through circuits, strain gauge, pressure, or temperature sensors
- Comprehend both theoretical aspects and experimental results
- Build and design basic instrumentation systems based on simulation or theories
- Solve engineering problems from concepts to experiments and may challenge to new areas
- Present results of some experiments in an understandable written report with QR (or QL) comments
-

Lecture topics include:

- Basic concepts with units and dimensions and generalized measurement system
- Analysis for Dynamical systems with distortion and impedance matching
- Data Analysis of experiments including uncertainty using probabilistic or statistical methods
- Electrical circuits, electronic instruments, and measurement tools to interpret mechanical quantities such as Op-amp, filter, multimeter, oscilloscope, transducer, and so on.
- Cantilever beam with Strain gages for the understanding of deformation, strain-stress relationship
- Dimensional measurement including displacement, surface, surface, velocity, accelerometer

measurement

- Measurement, methods for pressure and fluid flow system
- Temperature measurement & experiments considering geographical, electrical or mechanical effects
- Motion, vibration, thermal, and nuclear-radiation measurements
- Use engineering computational tools such as MATLAB/Simulink or VBA for simulation or experiments
- NI Data acquisition, signal conditioning, amplifying, and processing techniques

Lab Topics

- Measurements of electric circuits using instruments
- Op-Amp - basic electrical devices and signal conditioning
- Strain gage I – Installation of gages and experiment setup
- Strain gage II – Force, torque and strain measurement
- Temperature measurements – Installation of Temperature sensors and instruments
- Data Acquisition and signal processing, conditioning using NI LabVIEW SignalExpress
- Deformation with stresses-strains under applied forces using strain gages on a cantilever beam and data acquisition board, connected to computer programs

SCHEDULE:

Lectures: Two 50-minute lectures per week over a 10-week academic term.
Laboratory: One 3-hour lab. session per week over a 10-week academic term.
Credits: Three quarter-based term credits (2-3-3).

PROGRAM OUTCOMES: This course contributes to the following ABET-EAC Program Outcomes:

- an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- an ability to design and conduct experiments, as well as to analyze and interpret data (b)
- an ability to design and realize a physical system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c)
- Graduates will be able to function on multi-disciplinary teams (d)
- an ability to identify, formulate, and solve engineering problems (e)
- an ability to communicate effectively (g)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k)
- Graduates will be able to work professionally in the area of thermal systems (m1)
- Graduates will be able to work professionally in the area of mechanical systems (m2)

PREPARER:

Dongbin (Don) Lee, Ph.D.,
Assistant Professor, MMET Department
Winter 2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 418 – *Fluid Mechanics II*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

A continuation of the study of the principles and applications of fluids in engineering, including: fluid kinematics, dimensional analysis and modeling, differential analysis of fluid flow, Navier-Stokes equations, compressible flow, open-channel flow, and turbomachinery.

PREREQUISITES:

ENGR 355 – Thermodynamics
MATH 321 – Applied Differential Equations I
MECH 318 – Fluid Mechanics I

TEXTBOOK:

Fluid Mechanics: Fundamentals and Applications, 3/E, 2013 Y. A. Çengel and J. M. Cimbala, McGraw-Hill, ISBN 978-0073380322.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Ability to Apply Techniques of Dimensional Analysis and Modeling to Fluid Flow
- Understanding of the Need for both Differential and Integral Analysis of Fluid Flow
- Understanding of the Physical Meaning of the Terms in the Navier-Stokes Equations
- Ability to Apply Solutions of the Navier-Stokes Equations
- Ability to Apply Solutions of the Compressible Flow Equations
- Ability to Apply Solutions of the Open-Channel Flow Equations

TOPICS COVERED:

- Introduction and Review of Fluids I
- Fluid Kinematics
- Reynold's Transport Theorem
- Dimensional Analysis
- Modeling and Similitude
- Fluid Element Kinematics
- Inviscid Flow

- Potential Flow
- Navier-Stokes Equations
- Compressible Flow
- Open-Channel Flow
- Turbomachinery

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates will have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should be able to identify, formulate, and solve engineering problems (e).

PREPARER:

Brian Moravec
Professor, MMET Department
12/21/2015

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 436 – *Classical Control Systems*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
An introduction to control systems. Both classic control theory and programmable logic controllers are considered. Topics include block diagrams, mathematical models, transfer functions, LaPlace transforms, frequency responses along with control components and PLC programming.

PREREQUISITES:
MECH 480 – Mechanical Vibrations

TEXTBOOK:
Control Systems Engineering, 6/E (Nise), Wiley, 2011.

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Understanding of the elementary characteristics of Control System phenomena.
- Understanding of the classification categories for Control System phenomena.
- Ability to formulate the governing equations for Physical Systems.
- Ability to obtain transfer functions for controlled Physical Systems.
- Ability to analyze the response of controlled Physical Systems.
- Ability to perform experimental investigations of Control System phenomena.
- Ability to perform computational simulations of Control System phenomena.

TOPICS COVERED:
- Introduction to / Overview of Control Systems
- Developing Governing Equations for Physical Systems
- Analysis of Linear Systems via the Laplace Transform
- Modeling Physical Systems in the Frequency Domain
- Model Reduction: Block Diagrams and Transfer Functions
- Transient-Response Performance Measures
- System Stability: Concepts and Criteria
- Steady-State Error in Performance Objectives
- Root Locus: Concepts and Principles

- Root Locus: Compensation and Design*
- Frequency Response Techniques*

SCHEDULE:

Lectures: Two 50-minute lectures per week over a 10-week academic term.
Laboratory: One 3-hour lab. session per week over a 10-week academic term.
Credits: Three quarter-based term credits (2-3-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 437 – *Heat Transfer II*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
A study of experimental heat transfer. Methods and instrumentation used for investigating heat transfer systems will be considered. Laboratory investigations include studies of heat exchangers, forced and free convection experiments, and determination of radiation and convection coefficients.

PREREQUISITES:
MECH 323 Heat Transfer I
MECH 363 Engineering Instrumentation

TEXTBOOKS:
Bergman, T.L. et al, Introduction to Heat Transfer, 6th Ed., Wiley, 2011.

Moravec, B.A. Experimental Exploration of Heat Transfer, Oregon Tech, 2007.

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Select and use instruments, sensors, and transducers to conduct heat transfer tests.
- Install thermocouples, thermistors, flow devices, etc., to conduct heat transfer tests.
- Analyze the data from these tests for accuracy and reasonableness.
- By use of first law of thermodynamics and log mean temperature difference, calculate a heat balance.
- Calculate film coefficients for turbulent and laminar flow for air-to-air, water-to-water, etc., heat transfer.
- Calculate heat transfer through the various types of heat exchangers.
- The student shall also be able to perform the following in their reports:
  - Analyze data.
  - Present data in clear form.
  - Calculate results.
  - Present results in logical and clear form.
  - Plot curves and graphs of results.
  - Write up a clear, logical engineering report covering the procedure, analysis, results, and conclusions of the test or experiment.

TOPICS COVERED:

- Introduction and Review of Heat Transfer I
- Heat Exchangers
- Internal Convection Coefficients
- Boiling Heat Transfer
- Condensation Heat Transfer
- Extended Surfaces
- Transient Conduction, Lumped Capacitance
- Transient Conduction, Finite Difference Method
- External Forced and Free Convection Coefficients
- Solar Radiation
- Radiation

SCHEDULE:

Lectures: One 50-minute lecture per week and one 3-hour lab per week over a 10-week academic term.
Credits: Two quarter-based term credits (1-3-2).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates will have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates will have an ability to design and conduct experiments, as well as to analyze and interpret data (b)
- Graduates will have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates will have an ability to function on multidisciplinary teams (d).
- Graduates should be able to identify, formulate, and solve engineering problems (e).
- Graduates will have an ability to communicate effectively (g).

PREPARER:

Brian Moravec
Professor, MMET Department
04/01/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 480 – *Mechanical Vibrations*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

An introduction to mechanical vibration. Topics include the equations of motion, resonant frequencies, mode shapes, damping and applications. The laboratory will introduce vibration instrumentation.

PREREQUISITES:

ENGR 212 – Engineering Mechanics: Dynamics
ENGR 266 – Engineering Computation
MATH 321 – Applied Differential Equations I
MECH 315 – Machine Design I
MECH 363 – Engineering Instrumentation

TEXTBOOK:

Mechanical Vibration, 1/E (Palm), Wiley, 2007.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Understanding of the elementary characteristics of Mechanical Vibration phenomena.
- Understanding of the classification categories for Mechanical Vibration phenomena.
- Ability to formulate equations of motion for SDOF and MDOF systems.
- Ability to analyze the free and forced response of linear SDOF systems.
- Ability to analyze the free and forced response of linear MDOF systems.
- Ability to perform experimental investigations of Mechanical Vibration phenomena.
- Ability to conduct computational simulations of Mechanical Vibration phenomena.

TOPICS COVERED:

- Introduction to / Overview of Vibration
- Kinematics of Simple Harmonic Motion
- Free Vibration of SDOF Systems
    - Undamped and Damped Systems

    - Rayleigh’s Energy Method
    - Equivalent Parameterization
    - Various Types of Damping
- Forced Vibration of SDOF Systems
    - Undamped and Damped Systems
    - Sinusoidal Externally-Forced Excitation
    - Sinusoidal Base-Movement Excitation
    - Sinusoidal Rotating-Imbalance Excitation
    - Equivalent Linear Damping
    - Self-Excitation and Stability Analysis*
    - General Periodic Excitation
- Special Topics for SDOF Systems
    - Step and Impulse Response
    - Transient-Response Performance
    - Vibration Measurement Instruments
- Free and Forced Vibration of MDOF Systems
    - Two-Degree-of-Freedom Systems
    - General Linear MDOF Systems*
    - Derivation of Equations of Motion
    - Matrix Formulations and Operations
    - The Eigenvalue Problem
    - Modal Coordinates and Mode Shapes
    - Rayleigh Damping*
- Vibration Control Methods*
- Continuous (Distributed) Systems*

SCHEDULE:

Lectures: Two 50-minute lectures per week over a 10-week academic term.
Laboratory: One 3-hour lab. session per week over a 10-week academic term.
Credits: Three quarter-based term credits (2-3-3).

CRITERION MET:

[This section to be completed by program directors for each degree program.]

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)

- Graduates should have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 490 – *Senior Projects I*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
The first of a three-term comprehensive group design project, focusing on the design proposal. This sequence applies material from prior course work, along with concepts of project management, design optimization, and other material related to a group engineering project.

PREREQUISITES:
ENGR 355 Thermodynamics
MECH 315 Machine Design I
MECH 318 Fluid Mechanics I
MET 375 Solid Modeling
(or) Instructor Consent

TEXTBOOK:
None.

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Apply engineering skills and knowledge obtained through the students engineering education to an engineering project.
- Plan and carry out a small engineering project. This to include defining criteria, proposed solution, work breakdown, time line and budget.
- Communicate effectively, both written and oral.
- Work on an inter-disciplinary team.

TOPICS COVERED:
- Much of the work done in senior projects is dependent on the project undertaken. However, topics covered in lecture and which will be involved in all projects include:
  - Project Planning
  - Project tracking and management
  - Technical report preparation
  - Technical oral report preparation and presentation
  - Drawing creation and checking
  - Work on an inter-disciplinary team

SCHEDULE:

Lectures: Two 50-minute lectures per week and one 3-hour lab per week over a 10-week academic term.
Credits: Three quarter-based term credits (2-3-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates will have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates will have an ability to design and conduct experiments, as well as to analyze and interpret data (b)
- Graduates will have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates will have an ability to function on multidisciplinary teams (d).
- Graduates should be able to identify, formulate, and solve engineering problems (e).
- Graduates will have an ability to communicate effectively (g).

PREPARER:

Brian Moravec
Professor, MMET Department
04/01/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 491 – *Senior Projects II*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

The second of a three-term comprehensive group design project, focusing on project design.

PREREQUISITES:

MECH 490, previous term from same instructor
(or) Instructor Consent

TEXTBOOK:

None.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Apply engineering skills and knowledge obtained through the students engineering education to an engineering project.
- Plan and carry out a small engineering project. This to include defining criteria, proposed solution, work breakdown, time line and budget.
- Communicate effectively, both written and oral.
- Work on an inter-disciplinary team.

TOPICS COVERED:

- Much of the work done in senior projects is dependent on the project undertaken. However, topics covered in lecture and which will be involved in all projects include:
    - Project Planning
    - Project tracking and management
    - Technical report preparation
    - Technical oral report preparation and presentation
    - Drawing creation and checking
    - Work on an inter-disciplinary team

SCHEDULE:

Lectures: Two 50-minute lectures per week and one 3-hour lab per week over a 10-week academic term.
Credits: Three quarter-based term credits (2-3-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates will have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates will have an ability to design and conduct experiments, as well as to analyze and interpret data (b)
- Graduates will have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates will have an ability to function on multidisciplinary teams (d).
- Graduates should be able to identify, formulate, and solve engineering problems (e).
- Graduates will have an ability to communicate effectively (g).

PREPARER:

Brian Moravec
Professor, MMET Department
04/01/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 492 – *Senior Projects III*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
The third of a three-term comprehensive group design project, focusing on project construction and testing.

PREREQUISITES:
MECH 491, previous term from same instructor
(or) Instructor Consent

TEXTBOOK:
None.

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Apply engineering skills and knowledge obtained through the students engineering education to an engineering project.
- Plan and carry out a small engineering project. This to include defining criteria, proposed solution, work breakdown, time line and budget.
- Communicate effectively, both written and oral.
- Work on an inter-disciplinary team.

TOPICS COVERED:
- Much of the work done in senior projects is dependent on the project undertaken. However, topics covered in lecture and which will be involved in all projects include:
    - Project Planning
    - Project tracking and management
    - Technical report preparation
    - Technical oral report preparation and presentation
    - Drawing creation and checking
    - Work on an inter-disciplinary team

SCHEDULE:
Lectures: One 50-minute lectures per week and two 3-hour labs per week over a 10-week academic term.
Credits: Three quarter-based term credits (1-6-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates will have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates will have an ability to design and conduct experiments, as well as to analyze and interpret data (b)
- Graduates will have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates will have an ability to function on multidisciplinary teams (d).
- Graduates should be able to identify, formulate, and solve engineering problems (e).
- Graduates will have an ability to communicate effectively (g).

PREPARER:

Brian Moravec
Professor, MMET Department
04/01/2016

Selected Mechanical Engineering Electives

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 312 – *Dynamics II*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Elective: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
Continuation of the study of kinematics and kinetics of particles and rigid bodies, with applications to mechanical systems of current interest to engineers.

PREREQUISITE:
ENGR 212 – Engineering Mechanics: Dynamics
MATH 321 – Applied Differential Equations I

TEXTBOOK:
Vector Mechanics for Engineers: Dynamics, 10/E (Beer, Johnston, Cornwell), McGraw-Hill, 2013.

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Ability to combine Kinematic and Kinetic Relations to solve dynamics problems.
- Ability to recognize and solve problems with Constrained Motion of rigid bodies.
- Ability to apply Newtonian Principles to solve dynamics problems.
- Ability to apply Work-Energy Principles to solve dynamics problems.
- Ability to apply Impulse-Momentum Principles to solve dynamics problems.
- Understand the differences between planar (2-D) analyses and spatial (3-D) analyses.
- Understand the concepts and principles associated with Lagrangian Mechanics.

TOPICS COVERED:
- Particles Subjected to Central Forces
- Orbital Mechanics (Keplerian Orbits)
- Kinematics of Classical Mechanisms
- Moving Reference Frames and Relative Motion

- The Euler Equations of Motion for a Rigid Body
- Euler Angles and Gyroscopic Motion
- Work-Energy Methods for Rigid Bodies*
- Impulse-Momentum Methods for Rigid Bodies*
- Lagrangian Methods for Dynamical Systems*

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k).

PREPARER:

Jeffrey C. Hayen, Ph.D.
Associate Professor, MMET Department
02/27/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 404 – *Co-op Field Practice*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Elective: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

An approved work program related to the student's field of specialization for a continuous three-month period. The employer and the type, level, and difficulty of the particular job must be approved prior to the employment period. A written comprehensive report must be submitted during the following term of residence.

PREREQUISITES:

Approval of the BSME curriculum coordinator.

TEXTBOOK:

None.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Ability to work in an engineering work environment.

TOPICS COVERED:

- Variable, Independent study.

SCHEDULE:

Independent study; full-time engineering internship work for 3+ months (or equivalent).
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should be able to identify, formulate, and solve engineering problems (e).

PREPARER:

Brian Moravec

Professor, MMET Department
04/01/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 407 – Advanced Composites
SYLLABUS

REQUIRED FOR:
Elective for: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
The course combines theoretical and practical knowledge of modern and advanced composite materials for the student interested in applying this to composite design and selecting the appropriate composite material components for a given product. The course also focuses on manufacturing processes of composite materials.

PREREQUISITES:
NA

TEXTBOOK:
Manufacturing Processes for Advanced Composites by F.C. Campbell, Elsevier Publishing, ISBN 185617458

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Gain a broad understanding of composite materials including matrix materials, fiber types and forms, fiber-matrix compatability, and their inherent strengths and weaknesses.
- Understand the theoretical and hands on application and design of modern composite materials.
- Understand composite materials manufacturing processes.
- Gain a knowledge of composite material product design and the essence of sound engineering logic applied to design work focused on modern composite materials coupled with material selection and manufacturing process selection techniques.
- Provides the student with the knowledge necessary for applying micromechanics, ply mechanics, macromechanics and strength in design with utilizing composite materials.
- Students will be given an overview of damage repair, quality and testing of composite materials.

TOPICS COVERED:
- Introduction to composite materials and processes
- Fibers and Reinforcements

- Thermoset Resins
- Cure Tooling
- Ply collation
- Curing
- The interaction of Chemical Composition and Processing on Composite materials
- Adhesive Bonding and Integrally Cocured Structures
- Liquid Molding
- Thermoplastic Composites
- Commercial Processes
- Assembly
- Nondestructive and Inspection Repair

SCHEDULE:

Lectures: Two 50-minute lectures and one 150-minute lab per week over a 10-week academic term.
Credits: Three quarter-based term credits

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should be able to identify, analyze and solve technical problems (e).
- Graduates should have the ability to communicate effectively (g).

PREPARER:

Joe Stuart
Associate Professor, MMET Department
12/06/2015

OREGON INSTITUTE OF TECHNOLOGY

Mechanical and Manufacturing Engineering and Technology

MECH 407 Advanced Solid Modeling
SYLLABUS

REQUIRED/ELECTIVE FOR:
Elective: Mechanical Engineering

DESCRIPTION:
This course is an introduction to Solid Modeling techniques as applied to mechanical design. Topics include extruded and swept shapes, Boolean operations and other construction techniques.

PREREQUISITES:
MECH 315 Machine Design

TEXTBOOK:
Parametric Modeling with Autodesk Inventor, Shih, SDC Publications

COURSE LEARNING OUTCOMES:
Upon completion of this course students should be able to:

1. Be familiar with the terminology used in solid modeling and parametric modeling.
2. Identify the significant benefits of using solid modeling as a design tool.
3. Produce accurate and adequate engineering models.
4. Produce accurate engineering drawings for manufacturing.
5. Apply the modeling techniques taught to develop, and refine models.
6. Apply the software taught to problems in follow-on courses.

TOPICS COVERED:

- Introduction
  - Overview of 3-D modeling
  - 3D Solid modeling package in use
    - System structure and user interface
    - Boolean operation and Solid Primitives
    - Basic Editing
    - Parametric Modeling
    - Symmetrical features in designs
  - 2-D drawings from 3-D solids
    - 3-D annotations
    - 2-D Drawing layouts
    - Dimensioning
    - Title Block and Notes
- Assembly Modeling
  - Assembly Modeling methodology

Tree structure
Assembly Constraints
Motion analysis and Animations
Integration of data from other application software

SCHEDULE:
2 - 50 minute lectures/week over a 10 week term
3 term credits (3-2-3)

PROGRAM OUTCOMES:
This course contributes to the following Program Outcomes. These outcomes align with the EAC a-k outcomes.

c. Graduates should be able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
g. Graduates should have the ability to communicate effectively.
k. Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PREPARER:
Randy Shih
Professor, MMET
March 26, 2016

OREGON INSTITUTE OF TECHNOLOGY

Manufacturing and Mechanical Engineering and Technology

MECH 407 *Lean Manufacturing*

SYLLABUS

REQUIRED/ELECTIVE FOR:

Elective for: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

This course will introduce the principles, concepts and techniques of lean manufacturing. The students should learn one of the important techniques that help improve the manufacturing processes, quality of products and services. The students should reinforce their learning by group discussions, homework assignments, projects and exams. They should practice what they have learned from the course on real-world problems by conducting projects at local manufacturing or service organizations.

PREREQUISITES:

MFG 313 Manufacturing Analysis & Planning
Or MFG 333 Quality Improvement
Or Instructor Permission

TEXTBOOK:

Required:
Kaizen Revolution, by M.D. Regan and Mark Slattery, published by Holden Press, Inc., 2000, ISBN: 0-9663549-7-4.

Lean Thinking Feasibility and Case Studies, by Wangping Sun

Recommended reading:
JIT factory revolution, by Hiroyuki Hirano and the JIT Management Laboratory Company Ltd.
The shift to JIT : how people make the difference, by Ichiro Majima

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should be able to:

1. Understand and practice the basic concepts and principles of lean manufacturing, including muda, value added analysis, WIP, 5S principles, quick changeovers, cellular manufacturing, JIT, Kanban, pull system, takt time, preventative maintenance, kaizen event, etc.
2. Conduct value stream analysis and process mapping.
3. Identify muda in a manufacturing process.
4. Propose measures to eliminate or reduce muda.
5. Identify engineering problems related to production of goods and services.

6. Design and implement efficient production processes and systems to produce goods and services.
7. Measure, evaluate and improve production processes and systems to produce goods and services.
8. Participate and function in team environments.
9. Communicate effectively in a professional role with specific capability to present technical materials effectively.

TOPICS COVERED:

- Lean manufacturing implementation
- Kanban system
- Product planning and work cell
- Production smoothing, Jidoka and Poka -Yoke in industry
- Traveling sales man problem
- Process flow, process efficiency and line balance
- Job scheduling
- Direct Clustering Algorithm

SCHEDULE:

Two 50 minute lecture/week over a 10 week term
One 2 hour lab/week over a 10 week term
Credits: Three quarter-based term credits (2-1-2)

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should be able to function effectively on teams (d)
- Graduates should have the ability to communicate effectively (g)

PREPARER:

Yanqing Gao
Dept. of MMET
04/19/2016

OREGON INSTITUTE OF TECHNOLOGY

Manufacturing and Mechanical Engineering and Technology

MECH 407 *Mechanics of Composite Materials*

SYLLABUS

REQUIRED/ELECTIVE FOR:

Elective: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Study of the engineering mechanics of composite materials focusing on continuous fiber reinforced polymeric systems. Considers the micromechanics, mesomechanics (lamina), and macromechanics associated with composite materials – including hydrothermal effects. Course will begin with constitutive models leading up to the design of a composite structure for mechanical analysis.

PREREQUISITES:

Senior standing in a MMET degree program and instructor consent

TEXTBOOK:

Required:

Principal of Composite Material Mechanics

3rd edition, Gibson, CRC Press

COURSE LEARNING OUTCOMES:

Upon completion of this course students should be able to:

1. The student will become familiar with the classification, applications, terminology, and manufacturing methods of composite materials.
2. The student will develop the understanding of constitutive models necessary to apply the micro-mechanical analysis of a lamina, including stiffness, strength and coefficient of thermal and moisture expansion.
3. The student will develop the understanding necessary to be able to apply the macro-mechanical analysis of a lamina by applying anisotropic Hooke's law, stress-strain relationships for an angle lamina, and strength failure theories.
4. The student will develop a familiarity and application of the classical laminated plate theory including the global stress-strain relation for laminates based on the individual properties of laminae.
5. The student will be able to apply failure analysis of laminates including damage mechanisms and progressive failure for a laminate.
6. The student will be able to design a laminated composite structure.

TOPICS COVERED:

Constitutive Relationships

Continuous Fiber Composites

Micro-mechanics

Lamina mechanics
Macro-mechanics

Tentative Additional Topics
Discontinuous Fiber Composites
Particulate Composites

SCHEDULE:
Four 50 minute lectures/week over a 10 week term
Credits: Three quarter-based term credits (3-0-3)

PROGRAM OUTCOMES:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates should have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).

PREPARER:
Josh T Millard
Dept. of MMET
05/17/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 407 – *Race Car Component Design*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Elective: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

This course involves the design of a race car part(s), components, or manufacturing process for either the Formula SAE or Baja SAE competition. The course involves research, analysis, design work, and documentation.

PREREQUISITES:

Junior or Senior Standing.

TEXTBOOK:

For Formula SAE team members: "Learn and Compete"; Michael and Suzanne Royce; Racecar Graphic Limited; 2012.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Ability to design a part, component, or process to a series of constraints (Formula or Baja SAE rules).
- Ability to document their results to a given report format.

TOPICS COVERED:

- Topics vary depending on the part(s), components(s), or manufacturing process selected; they may include:
  - Brief introduction of the component including interaction with other components
  - Solid model of the component
  - Manufacturing plan
  - Calculations involved
  - Computer analysis (FEA, CFD, etc as appropriate)

SCHEDULE:

Lectures: Three 50-minute lectures per week over a 10-week academic term; this varies per student project selected.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates will have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- Graduates will have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. (c).
- Graduates should be able to identify, formulate, and solve engineering problems (e).

PREPARER:

Brian Moravec
Professor, MMET Department
04/01/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MECH 407 – *System Dynamics*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Elective for: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
Modeling and analysis and design of linear deterministic systems in both the time and frequency domains. Input/output differential equations, Laplace transforms and state space methods. Attention will be given to modeling physical and engineering systems and computer simulations.

PREREQUISITES:
MATH321 Applied Differential Equation

TEXTBOOK:
System Dynamics, by Katsuhiko Ogata, Prentice Hall, Forth Edition, ISBN 0131424629

COURSE LEARNING OUTCOMES:
Students will understand simplified models for mechanical, electrical, fluid and thermal objects. Learn to build mathematical models that closely represent behaviors of those physical systems. Develop system responses to various inputs so that student can effectively analyze and design dynamic systems. Also be able to obtain computer solutions of system responses with MATLAB

TOPICS COVERED:
- Laplace transform
- Mechanical Systems
- Transfer function approach to modeling dynamic systems
- State-space approach to modeling dynamic systems
- Time-domain analysis of dynamic systems
- Frequency –domain analysis of dynamic systems

SCHEDULE:
Lectures: two 75minute lectures per week over a 10-week academic term.
Credits: Three quarter-based term credits (3-0-3).

PROGRAM OUTCOMES:
This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a).

- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).

PREPARER:

Yanqing Gao
Dept. of MMET
04/19/2016

OREGON INSTITUTE OF TECHNOLOGY

Mechanical and Manufacturing Engineering and Technology

MECH407 Robotics

REQUIRED/ELECTIVE FOR: Elective: Bachelor of Science Mechanical Engineering

DESCRIPTION: This course is concerned with fundamentals of robotics, including mechanisms, modeling, and design such as forward and inverse kinematics, Jacobians, Lagrangian dynamics, followed by motion planning, design of multiple controllers, and computer vision. Furthermore, many detailed examples and extensive problems solving will be introduced to illustrate robotic theories. The lab session provides students with relevant skills and techniques, advanced engineering experimental technologies so that they can learn how such robotic systems are working in a variety of applications where typical industrial robotics, e.g., FANUC Robotics, KUKA robots and autonomous mobile robots, sensors, actuators are targeted to practice. Complete understanding of industrial robotics is the main concern and in addition, each student builds an automated guided mobile robot while learning robot programming. With understanding of concurrent robotic systems and the experience, each student enables her/his capability to contribute to carry out projects, tasks, development, or research on her/his concerns.

PREREQUISITES or CO-REQUISITES:
None (technically, senior-level students who have already taken trig. & algebra, or instructor's consent)

TEXTBOOK:
- Robotics:Modelling, Planning & Control, Bruno Siciliano, et al, springer, '09, ISBN:978-1-84628-641-4
- (Suppl')Arduino Robotics, John-David Warren et al, APress, '11, ISBN-13 (pbk): 978-1-4302-3183-7

COURSE LEARNING OUTCOMES:
Upon completion of this course students should be able to:

- Understanding of fundamentals; rotation, and structure of robotic joints and link systems.
- Introduction to robot modeling and design including forward and inverse kinematics
- Study of Jacobian, kinematics, dynamics, motion planning, vision, and design of multiple controllers
- Analysis on a variety of robotic joints and operation/motion of the systems
- Understanding robot systems on industrial robots, mobile robots, underwater robot, unmanned aircraft systems, or small-scale robotic manipulator systems
- Forward and inverse kinematics (use MATLAB/Simulink), Operation & FANUC Robot

programming

- Experiments of small-scale robot manipulators using computer systems including microcontroller(s)
- Advanced robot programming utilizing robot Input/Output Signals, Macros, etc.
- Automation/automated system implementation through teamwork while acquiring comm. skills

SCHEDULE:

2 - 50 minute lectures/week and 1 3-hour lab/week over a 10 week term
3 term credits (2-3-3)

Class and Lab: List of topics to be covered:

- Introduction to FANUC Robotics
- Revamp Mathematical Background, Robot Programming (MATLAB)
- FANUC Forward Kinematics (6DOF) Composition of rotations, Euler Angles, Homogeneous Matrix
- Robot Modeling-Denavit-Hartenberg (DH)
- Understanding/Modeling: A variety of Robot Design, Modeling using D-H
- Inverse Kinematics (Ch.02)
- Review of Fwd and Inv. Kinematics (Ch3)
- Differential Kinematics/Statics (Ch.4)
- Inverse Differential Kinematics (Ch.4)
- Dynamics (Ch.07): Lagrangian Formulation
- Motion/Force/torque Control (Ch8/9)
- Actuators, Sensors (Ch.06) – Encoder, etc.
- Computer Vision – Image Processing (Ch11)
- 10 weeks Lab sessions regarding FANUC Robotics and Arduino-based mobile robot.

PROGRAM OUTCOMES:

This course contributes to the following Program Outcomes. These outcomes align with the EAC a-k outcomes.

- an ability to design and conduct experiments, as well as to analyze and interpret data (b)
- an ability to identify, formulate, and solve engineering problems (e)
- Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

PREPARER: Dongbin (Don) Lee, Ph.D,
Assistant Professor, MMET
April 25, 2016

OREGON INSTITUTE OF TECHNOLOGY

Manufacturing and Mechanical Engineering and Technology

MECH 407 Fluid Power Systems
SYLLABUS

TECHNICAL ELECTIVE FOR:
Bachelor of Science in Mechanical Engineering

DESCRIPTION:
This class uses hydraulic and pneumatic methods to convert pressure to movement. It evaluates different mechanisms in the pumps, valves, and actuators to facilitate this effectively. Control mechanisms are implemented directly in the lab.

PREREQUISITES:
MECH 318 Fluid Mechanics I

TEXTBOOK:
Fluid Power with Applications, 6^{nd} edition, Esposito, ISBN 0-13-060899-8

COURSE LEARNING OUTCOMES/TOPICS COVERED:
Upon completion of this course students should be able to:

- Design Pneumatic and Hydraulic Circuits
- Select Linear and rotary fluid power actuators
- Calculate pressure losses and line sizes
- Identify and describe key components of hydraulic and pneumatic systems

SCHEDULE:
Two 50 minute lectures/week over a 10 week term
One 3 hour lab/week over a 10 week term
Credits: Three quarter-based term credits (2-3-3)

PROGRAM OUTCOMES:
This course contributes to the following ABET-EAC Program Outcomes:

- Graduates will have an ability to analyze and model physical systems or components using mathematics, basic science and engineering (a).
- Graduates will have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. (c).
- Graduates should be able to identify, formulate, and solve engineering problems (e).

PREPARER:
Sean Sloan

Assistant Professor, MMET Department
06/08/2016

OREGON INSTITUTE OF TECHNOLOGY

Manufacturing and Mechanical Engineering and Technology

MECH 407 Nuclear Power
SYLLABUS

TECHNICAL ELECTIVE FOR:
Bachelor of Science in Mechanical Engineering

DESCRIPTION:
This class covers nuclear power from nuclear theory and the multiplier through to power plants and their economic impact. It provides similar content to what nuclear power officers learn in the US Navy in order to understand and manage their Naval Reactor. All information is unclassified.

PREREQUISITES:
1 term of Chemistry
Recommended; 1 term of Fluid Dynamics

TEXTBOOK:
Murray, Nuclear Energy, 6th Edition, Butterworth-Heinemann., 2009.
ISBN: 978-0-12-370547-1

COURSE LEARNING OUTCOMES/TOPICS COVERED:
After completing this course, the student will be able to:

- Use and calculate values of the basic principles of nuclear physics.
- apply nuclear principles to create power multipliers.
- Identify differences between PWR, BWR, and others.
- Make radiation REM calculations,
- Design radiation shielding
- Understand biological effects and how it is modeled.
- Distinguish Radioactive material and radiation
- Do decay heat calculations
- Calculate criticality and reaction rates
- Assess a Probability Risk Assessment
- Identify component use in nuclear safety
- Understand the roles of the nuclear agencies; NRC, DOE, IAEA
- Understand the Causes of major accidents (TMI, Chernobyl, Daiichi)
- Compare Nuclear, with Coal and Wind
- Understand differences between Fission, Fusion, and Breeder reactors
- Explain limits for non-proliferation and what makes a nuclear weapon

SCHEDULE:
Three 50 minute lectures/week over a 10 week term
Credits: Three quarter-based term credits (3-0-3)

PROGRAM OUTCOMES:

This courses contributes to the following ABET-EAC Program Outcomes,

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering apply knowledge of mathematics, science and engineering. (a)
- Graduates should be able to identify, formulate, and solve engineering problems. (e)
- Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

PREPARER:

Sean Sloan
Dept. of MMET
6/8/2016

OREGON INSTITUTE OF TECHNOLOGY
Mechanical and Manufacturing Engineering Technology

Computational Fluid Dynamics (CFD), MECH 407
Syllabus

TECHNICAL ELECTIVE: Mechanical Engineering

PREREQUISITES: any Fluids I. Recommended, Fluids II, Finite Element Analysis

TEXTBOOK: STAR-CCM+ v10
Electronic materials distributed in class
Active account on Steve Portal (**steve**.cd-adapco.com)

DESCRIPTION: Students will learn the theory of Computational Fluid Dynamics (CFD) and implement separate class projects which convert a CAD system into a CFD analysis where they evaluate multiple design contingencies.

COURSE LEARNING OUTCOMES/TOPICS COVERED:

- Able to mesh and refine a CFD mesh from CAD
- Able to apply Boundary Conditions
- Implement different physics models
- Manage computational limits and constraints
- Present data in a meaningful way
- Identify convergence
- Implement a mesh sensitivity study

SCHEDULE: One 2 hour period and one 3 hour period combining lecture and lab

PROGRAM OUTCOMES:

This courses contributes to the following ABET-EAC Program Outcomes,

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering. (a)
- Graduates should be able to identify, formulate, and solve engineering problems. (e)
- Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

PREPARER:

Sean Sloan
Dept. of MMET
06/08/2016

OREGON INSTITUTE OF TECHNOLOGY

Mechanical and Manufacturing Engineering and Technology

MECH 475 Parametric Modeling
SYLLABUS

REQUIRED/ELECTIVE FOR:
Elective: Mechanical Engineering

DESCRIPTION:
Introduces feature-based parametric solid modeling techniques as applied to Mechanical Design. Emphasizes the concepts and practices of parametric modeling from the user's perspective. Theoretical and development backgrounds are also covered.

PREREQUISITES:
MET 375 Solid Modeling

TEXTBOOK:
Parametric Modeling with Solidworks, Schilling & Shih, SDC Publications

COURSE LEARNING OUTCOMES:
Upon completion of this course students should be able to:

7. Be familiar with the terminology used in solid modeling and parametric modeling.
8. Identify the significant benefits of using solid modeling as a design tool.
9. Produce accurate and adequate engineering models.
10. Produce accurate engineering drawings for manufacturing.
11. Apply the modeling techniques taught to develop, and refine models.
12. Apply the software taught to problems in follow-on courses.

TOPICS COVERED:

- Introduction
  - Overview of 3-D modeling
- 3D Solid modeling package in use
  - System structure and user interface
  - Boolean operation and Solid Primitives
  - Basic Editing
  - Parametric Modeling
  - Symmetrical features in designs
- 2-D drawings from 3-D solids
  - 3-D annotations
  - 2-D Drawing layouts
  - Dimensioning
  - Title Block and Notes
- Assembly Modeling
  - Assembly Modeling methodology

    - Tree structure
    - Assembly Constraints
    - Motion analysis and Animations
- Kinematic Analysis
    - Linkage simulation
    - 3D kinematic analysis

SCHEDULE:

2 - 50 minute lectures/week over a 10 week term
3 term credits (3-2-3)

PROGRAM OUTCOMES:

This course contributes to the following Program Outcomes. These outcomes align with the EAC a-k outcomes.

c. Graduates should be able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
g. Graduates should have the ability to communicate effectively.
k. Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PREPARER:

Randy Shih
Professor, MMET
March 26, 2016

Required General Education Courses

Humanities 125: Introduction to Technology, Society, and Values

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Yasha Rohwer
yasha.rohwer@oit.edu
Office hours Tuesday 10 am - 1 pm and by appointment in Semon Hall, room 104.

Contacting Me
The best way to reach me is via email. I check my email frequently during business hours; however, be patient if I don't immediately reply. You can also try me at my office phone: (541) 885-1942

Textbook
James and Stuart Rachels. *The Elements of Moral Philosophy.* The seventh edition.
Allen Buchanan. *Better than Human: The Promise and Perils of Enhancing Ourselves.*
There will also be articles posted to blackboard.

Broad Course Goals

1) Learning fundamental principles, generalizations, or theories.
2) Developing a clearer understanding of, and commitment to, personal values.
3) Learning to analyze and critically evaluate ideas, arguments, and points of view.

Course Goals
Are all technological advancements morally good? Put differently, are some technological innovations or applications not morally permissible? In this course we will become familiar with three technological developments (genetic engineering, geoengineering and cognitive enhancement) and examine the moral status of each. In order to do this, we will first become familiar with some of the most influential ethical theories, which can then be used to examine specific ethical questions concerning these technologies. The main goal of this course is to provide you with the critical thinking skills to make rational ethical decisions concerning emerging technologies. We will learn how to recognize arguments, to tell a good argument from a bad one, and to express our own ideas in the form of an argument. Together, we will use our newly acquired tools to tackle the tough questions raised by these technologies and by the end of the quarter students should be able to transfer these skills to examine the moral status of any technology.

How to succeed
Do the readings. You will get more out of the course and get a better grade. Bring all textbooks to class meetings. Come to every class. The majority of the information on the tests and the skills needed to write the papers will flow from class discussion. Philosophy is a conversation in which we learn from each other. Asking questions, discussing the material and arguing (politely) also helps you understand the material and helps you develop the tools and skills that will be useful for our papers, our exams, and life in general. Moreover, it makes section more enjoyable for everyone. **Constructive participation in class can increase your final grade.** Finally, approach the material with an open mind. If you are not prepared to consider the possibility that, say, your current view on the moral status of genetically modified foods is incorrect, then you will most likely find this course very challenging.

Grades
Surprise Quizzes are worth 10% of your final grade.
Paper #1 (2 pages) is worth 20% of your final grade.
The midterm is worth 25% of your final grade.
Paper #2 (3 pages) is worth 20% of your final grade.
Group presentation final is worth 25% of your final grade.

Assignments, quizzes, and tests will be given letter grades. 100-90% =A, 89-80% = B, 79-70% = C, 69-60% = D, 59% or below = F. The class will not be curved. **Final grades will not be rounded up.**

Tentative Class Schedule
Week 1: Introductions, arguments and what is morality
Week 2: Implausible moral theories and plausible moral theories
Week 3: Plausible moral theories continued
Week 4: Genetic engineering (Paper #1 due on the last day of the week)
Week 5: Genetic engineering
Week 6: Geoengineering (Midterm will take place on the last day of the week)
Week 7: Geoengineering
Week 8: Cognitive enhancement
Week 9: Cognitive enhancement
Week 10: Cognitive enhancement (Paper #2 due on the last day of the week)
Final Exam: See OIT final exam schedule – in the same room as class.

This schedule is tentative and may change as the quarter progresses. Readings required for the next class meeting will be announced at the end of the previous class. Make sure to do the readings since surprise quizzes are given throughout the quarter.

Attendance and class conduct
It is unwise to miss class. You are responsible for keeping up with announcements made during class about changes in the schedule regarding readings, exams, and papers. Failure to be aware of possible changes will not result in a make-up assignment. For this reason, if you miss class, you should contact a classmate immediately to check for possible changes.
Be respectful of other people in the class. Do not use your phone in class; that is, do not text, browse the web or play on it. This sort of behavior is disrespectful to me and to your fellow students. Your phone should be turned off and put away when class starts. I will ask you politely to put away your phone the first time. If the problem continues I will ask you to leave the class. Do not talk when other students are talking. If you would like to contribute to the class discussion, please raise your hand.

Late or Missed Work
Late work will only result in make-up assignments provided there is a documented legitimate excuse. If you anticipate being absent during the semester, come see me early to make alternative arrangements. If you miss a quiz and you have documented legitimate excuse, you must make up the quiz or make arrangements to make it up within one week.

Student Academic Integrity
"Academic dishonesty is defined as cheating, plagiarism or otherwise obtaining grades under false pretenses. Plagiarism is defined as submitting the language, ideas, thoughts or work of another as one's own or assisting in the act of plagiarism by allowing one's work to be used in this fashion. Cheating is defined as, but not limited to: obtaining or providing unauthorized information during an examination through verbal, visual or unauthorized use of books, notes, text and other materials; obtaining or providing unauthorized information concerning all or part of an examination prior to that examination; taking an examination for another student or arranging for another person to take an exam in one's place; altering test answers after submittal for grading; changing grades after grades have been awarded; or altering other official academic records" (Oregon Tech Student Handbook). I take cheating seriously. Academic dishonesty will result in a failing grade for the assignment.

Disability Services
"If you may need a course adaptation or academic accommodation because of a disability, or if you might need special arrangements in case the room or building must be evacuated, please see me as soon as possible. I rely on the Disability Services for assistance in verifying the need for accommodations and developing accommodation strategies. If you have not previously contacted that Office I encourage you to do so. You can call 885-1031 or 885-1129 for further assistance. Disability Services is located in LRC 228." (Oregon Tech Disability Services Faculty Handbook)

College of Health, Arts and Science
Department of Philosophy
PHIL 331: Ethics in the Professions

Catalogue Description (2015–2016):	Applied ethics course that focuses on examining ethical issues common to the professions, such as privacy, confidentiality, social responsibility and whistle-blowing. Emphasizes critical thinking and ethical decision-making skills.
Hours/Credits: (Lecture-Lab-Total)	(3-0-3)
Class Schedule:	Three hours of lecture each week
Lab Schedule:	Zero hours of lab each week
Prerequisites:	WRI 123 or WRI 227
Textbook:	*The Elements of Moral Philosophy*, 7th edition, James and Stuart Rachels *Ethics Across the Professions,* Clancy Martin, Wayne Vaught, and Robert C. Solomon.
Regular Instructors:	Yasha Rohwer
Course Objectives:	1) Learning fundamental principles, generalizations, or theories. 2) Developing a clearer understanding of, and commitment to, personal values. 3) Learning to analyze and critically evaluate ideas, arguments, and points of view. Is it ever permissible to lie in a professional setting? What are the limits of confidentiality? Does one always have the duty to be a whistleblower? What are the social responsibilities of professionals? This course will examine these and other ethical questions that concern professional workers. First we will become familiar with some of the most influential ethical theories, which we will then use to examine the specific moral situations that occur for professionals. The main goal of this course is to provide you with the critical thinking skills to make rational ethical decisions in your profession. We will learn how to recognize arguments, to tell a good argument from a bad one, and to express our own ideas in the form of an argument. Together, we will use our newly acquired tools to tackle the tough ethical questions in professional fields and by the end of the quarter students should be able to transfer these skills to approach any ethical situation in their field. We will also critically examine the ethical codes of the different professions that students will be going into.

opics Covered:	• Introductions and arguments • What is morality, implausible moral theories, and plausible moral theories • Plausible moral theories continued • What is it to be a professional? (Paper #1 due on the last day of the week) • Professional duties and clients' rights • Truth, lies and deception (Midterm will take place on the last day of the week) • Privacy, confidentiality, secrecy and trust • Integrity and loyalty • Professionalism, justice and social welfare • Professionalism, justice and social welfare continued		
Relevant Program Outcomes:			
Required or Elective:	Required		
Criterion 5:	General Education		
Prepared By:	Alicia Jones	Updated:	05/24/2016

College of Health, Arts and Sciences
Communication Department
SPE 111: Fundamentals of Speech

Catalog Description (2015/2016):	Public speaking with emphasis on content, organization, and speaker adjustments to various situations; dynamics of the speaker-listener interaction; and appropriate language usage. Includes informative, demonstrative, and persuasive speeches.
Hours/Credits: (Lecture-Lab-Total)	(2-2-3)
Class Schedule:	Two hours of lecture per week
Lab schedule	Two hours of lab per week
Prerequisites:	none
Required text and other Supplemental Materials:	Beebe and Beebe: *A Concise Public Speaking Handbook*, Pearson Education, Inc.
Regular Instructors or Course Coordinator:	Course Coordinator: Robin Schwartz. Regular instructors: Dr. Matt Schnackenberg; Dr. Christian Vukasovich; Dr. Dan Petersen; Dr. Veronica Koehn; Chris Syrnyk; Dr. Kari Lundgren; Andria Fultz.
Course Objectives:	Upon completion of the course, students should be able to: • Organize interesting speeches that can be given within a time limitation in these general categories: informative, demonstrative, and persuasive. • Prepare and deliver interest-rousing introductions and closings to a speech. Use transition signals, definitions, and analogy. Understand and use varied methods of organization. • Deliver the speech clearly with adequate volume and in appropriate English. Use voice range to add interest and emphasis. • Appear poised, maintain good posture, use gestures meaningfully and firmly overcome lapses with grace and good humor. • Choose significant topics, conduct appropriate research, and reflect the complexity of issues. • Prepare and use visual aids effectively to add interest and clarity to a speech. • Use correct APA attributions and citations. • Speak before groups with more confidence than at the beginning of the term. • Evaluate the impact, credibility, accuracy, organization, and delivery of speeches.

	• Write speech outlines that follow a standard format. • Prepare a through and honest self-analysis of each speech given. • Develop strategies for engaging an audience.
Topics Covered:	• Public speaking • Rhetoric
Relevant Student Outcomes:	(d) an ability to function on multi-disciplinary teams. (g) an ability to communicate effectively.
Required or Elective:	Required
Criterion 5:	General Education
Prepared By:	Robin J. Schwartz Updated: 2/16/2016

College of Health, Arts and Science
Department of Communication
SPE 321: Small Group and Team Communication

Catalogue Description (2015–2016):	Provides instruction and experience in decision making through group processes designed to develop competent team leaders and participants. Participation in and evaluation of a variety of group communication exercises.
Hours/Credits: (Lecture-Lab-Total)	(2-2-3)
Class Schedule:	Two hours of lecture each week
Lab Schedule:	Two hours of lab each week
Prerequisites:	SPE 111
Textbook:	*Working in groups,* Engelberg, I. & Wynn, D. (2010).
Regular Instructors:	Veronica Koehn
Course Objectives:	This course focuses on the student and groups. Students will be challenged to observe and examine their own communication style in relation to others, the student's impact within groups, the impact of others' actions, and the dynamic properties of group behavior. Specifically, the course objectives offer you the opportunity to acquire the fundamental principles and theories for working with others as a member of a team. The course also encourages application of knowledge and skills in: • Communication Apprehension • Group Stages • Listening • Task and Social Roles • Leadership • Controversy and Conflict • Meeting Organization • Diversity • Analysis of Group Process • Turn Organization
Topics Covered:	• Techniques and tools for conversing in groups • Advantages and disadvantages of working in groups • Group development and maintenance • Group membership • Dealing with apprehensive members • Diversity in groups • Group leadership

	• Verbal and nonverbal communication in groups • Listening in groups • Conflict and cohesion in groups • Problem solving in groups • Critical thinking and argumentation in groups • Planning and conducting meetings • Working in groups for final project		
Relevant Program Outcomes:	(d) an ability to function on multi-disciplinary teams. (g) an ability to communicate effectively.		
Required or Elective:	Required		
Criterion 5:	General Education		
Prepared By:	Alicia Jones	Updated:	05/17/2016

Oregon TECH

College of Health, Arts and Science
Department of Communication
WRI 121: English Composition

Catalogue Description (2015–2016):	Introduces critical reasoning and analysis. Explores connections between thesis, structure, tone and purpose; includes writing process, rhetorical strategies applications. Focuses on academic reading, writing and research skills.
Hours/Credits: (Lecture-Lab-Total)	(3-0-3)
Class Schedule:	Three hours of lecture each week
Lab Schedule:	Zero hours of lab each week
Prerequisites:	Writing ability as demonstrated by SAT/ACT score and/or writing sample.
Textbook:	*A Reader's Guide to College Writing*, 2014, John J. Ruszkiewicz
Regular Instructors:	Christopher Syrnyk
Course Objectives:	**Rhetorical Knowledge and Application** By the end of WRI 121, students should • Develop a controlling idea in each completed essay • Focus on a clear purpose • Adopt appropriate voice, tone, and level of formality for the needs of different audiences • Respond appropriately to different kinds of rhetorical situations • Write in multiple academic genres, including summary/response • Recognize and apply the principles of the Rhetorical Triangle (logos, pathos, ethos) **Critical Thinking, Reading, and Writing** By the end of WRI 121, students should • Use reading and writing for learning and thinking, by asking questions and seeking answers • Adopt the habit of questioning their own assumptions and opinions • When reading, identify and analyze the main issues in an essay • When writing, formulate a clear and precise personal point of view • Demonstrate proficiency in information literacy **Processes** By the end of WRI 121, students should • Use writing processes to invent, draft, revise and edit toward a final draft • Critique their own and others' writings • Revise at the document and paragraph levels; edit at the sentence and word levels • Complete a minimum of 3000 words (or about 12 pages, double-spaced) of polished writing • Write a summary/response paper **Knowledge of Conventions and Style**

	By the end of WRI 121, students should • Use standard academic English to address an academic audience • Control surface features such as grammar, punctuation, and spelling • Adapt style appropriately to a given rhetorical situation • Demonstrate an appropriate use of syntax and sentence structures • Use APA format (attribution, internal citations, and documentation) correctly
Topics Covered:	• Contexts, common readings, reviews, course syllabi • Authors and publishers, scholars and their work, popular sources vs. scholarly sources • Audiences and publics, academic communities, thinking about readers • Genres, narratives, reports, arguments • Sources • Critical reading, reading strategies, thinking for analytical purposes • Claims and contents • Examining evidence • Disputation, conceding, rebutting • Summary, annotation, and paraphrase • Discussion, response writing • Composition process • Making a point, thesis development • Structure, paragraphing, organization • Evidence and research • Frame ideas and quotations • Style • Clarity and economy
Relevant Program Outcomes:	(g) an ability to communicate effectively.
Required or Elective:	Required
Criterion 5:	General Education
Prepared By:	Alicia Jones Updated: 05/17/2016

College of Health, Arts and Science
Department of Communication
WRI 122: Argumentative Writing

Catalogue Description (2015–2016):	Designed to develop skills in ethical argument, research, critical thinking. Multipage papers, including argumentative research paper, required. Focuses on writing process with attention to audience, effective style, overall rhetorical effect.
Hours/Credits: (Lecture-Lab-Total)	(3-0-3)
Class Schedule:	Three hours of lecture each week
Lab Schedule:	Zero hours of lab each week
Prerequisites:	WRI 121 with grade "C" or better.
Textbook:	*From inquiry to academic writing: a text and reader*, 2015, Greene, S., & Lidinsky, A.
Regular Instructors:	Kari Lundgren
Course Objectives:	**Rhetorical Knowledge and Application** • Develop a thesis or claim in each completed essay that identifies the essay as a form of argument or analysis • Write well-organized, persuasive essays that accomplish a clear purpose by adopting appropriate voice, tone, and level of formality • Respond appropriately to different kinds of rhetorical situations • Recognize and effectively apply the principles of the Rhetorical Triangle (logos, pathos, and ethos) **Critical Thinking, Reading, and Writing** • Use library databases to conduct research • Evaluate the quality of source material • Adopt the habit of looking closely and questioning not only the assumptions and arguments of sources, but also a student's own assumptions and arguments • Identify and evaluate implications, conclusions, and consequences in their own and others' writings • Evaluate data and evidence • Identify and analyze the main points of a disputed issue • Identify and explain various contexts (i.e., cultural, social, educational, technological, political) • Formulate a clear personal point of view, while constructively acknowledging other perspectives and providing convincing counter-arguments • Recognize differing stakeholders and possible tensions or conflicts of interest among them

	Processes • Use writing processes to invent, draft, revise, and edit to create a final draft • Critique their own and others' writings • Revise at the document and paragraph levels; edit at the sentence and word levels • Complete a minimum of 5000 words (or about 20 pages, double-spaced) of polished writing • Write a 5-8 page argumentative research paper **Knowledge of Conventions and Style** • Learn common structures for different kinds of texts (traditional and delayed thesis essays) • Use standard academic English to address an academic audience • Adapt style appropriately to a given rhetorical situation • Demonstrate an appropriate use of syntax and sentence structures • Control surface features such as syntax, grammar, punctuation, and spelling • Effectively integrate primary and secondary sources into their writing • Use APA format (attribution, internal citations, and documentation) correctly
Topics Covered:	• Precisely, objectively, and concisely interpreting and explaining a single author's argument (**Assignment: Analytic Summary**) • Accurately integrating and documenting other authors' views into a concise and focused argument about an issue (**Assignment: Argued Response**) • Constructing a research question; analyzing and organizing several authors' responses to the question in order to identify and objectively explain major approaches to an issue; identifying a case in current events that exemplifies real-world implications of issue (**Midterm Assignment: Argument Synthesis**) • Identifying and articulating a gap in the scholarly conversation about an issue; gathering, integrating, and documenting credible sources with which to build a researched argument filling that gap (**Assignment: Academic Contribution Paper**) • Analyzing a specific's audience's needs and values; addressing audience need with a concise, focused, and timely argument (**Assignments: Op-Ed and Op-Ed presentation**)
Relevant Program Outcomes:	(g) An ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature. (i) an ability to engage in independent learning and recognize the need for continual professional development.
Required or Elective:	Required
Criterion 5:	General Education
Prepared By:	Alicia Jones | Updated: 05/17/2016

College of Health, Arts and Science
Department of Communication
WRI 227: Technical Report Writing

Catalogue Description (2013–2014):	Focuses on techniques of gathering, organizing, and presenting technical information and graphics. Requires technical reports derived from realistic situations in the student's major.
Hours/Credits: (Lecture-Lab-Total)	(3-0-3)
Class Schedule:	Three hours of lecture each week
Lab Schedule:	Zero hours of lab each week
Prerequisites:	WRI 121 & WRI 122
Textbook:	*Technical Communication in the Twenty-First Century,* 2nd edition by Sidney I. Dobrin, Christopher J. Keller, and Christian R. Weisser.
Regular Instructors:	Franny Howes
Course Objectives:	Upon completion of the course, a student should be able to: • Develop your skills at expressing yourself through writing (and to a lesser extent, orally). • Learn the fundamental principles and theories of technical communication. • Apply these theories and principles to real-world writing situations.
Topics Covered:	This course is centered around the production of a formal, research-based technical report. Along the way, we will be producing other documents, including memos, a proposal, a progress report, job documents, and oral presentations. • Topics this course covers include rhetoric, technical writing ethics, scholarly research, citation standards, organization of documents, technical style, grammar and editing, document formatting, and professionalism.
Relevant Program Outcomes:	(g) An ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature. (i) an ability to engage in independent learning and recognize the need for continual professional development.
Required or Elective:	Required
Criterion 5:	General Education
Prepared By:	Alicia Jones — Updated: 05/17/2016

College of Health, Arts and Science
Department of Communication
WRI 327: Advanced Technical Writing

Catalogue Description (2015–2016):	Processes involved in technical writing and methods of preparing technical data; offers a variety of writing problems to provide opportunities for the student to develop precision in statement and in graphic presentation.
Hours/Credits: (Lecture-Lab-Total)	(3-0-3)
Class Schedule:	Three hours of lecture each week
Lab Schedule:	Zero hours of lab each week
Prerequisites:	WRI 227
Textbook:	*Handbook of Technical Writing*, 10th edition, Alred et al.,
Regular Instructors:	Marilyn Dyrud
Course Objectives:	During WRI 327, students should develop the ability to • Demonstrate self-motivation in research and problem solving • Devise a personal writing schedules meet the deadlines • Abide by format specifications for various types of written communications • Write common types of technical/business communications, including abstracts, informative flyers, • trip reports, recommendation reports, proposals, instruction manuals, area evaluations, formal reports • Decide which form is most suitable for information in a specific situation: letter, memo, short report, • long report • Use a variety of techniques for revision and editing • Constructively critique the writing of others, both orally and in writing • Discuss writing problems, possible solutions, sources of information, etc. in a seminar setting • Define and address a variety of audiences, *e.g.*, peers, professionals, clients, supervisors, fellow • hobbyists, etc. • Develop graphic aids and effectively integrate them effectively with text • Accept and objectively evaluate criticism of work, by instructor and peers • Demonstrate an understanding of document design to produce aesthetically pleasing work **IDEA Center Objectives** • Learning to *apply* course material (to improve thinking, problem solving, and decisions) • Developing specific skills, competencies, and points of view needed by professionals in the field

	most closely related to this course • Developing skill in expressing oneself orally or in writing • Learning how to find and use resources for answering questions or solving problems • Learning to *analyze* and *critically evaluate* ideas, arguments, and points of view
Topics Covered:	• How to write personal papers (e.g., personal statements for med school, essays for grad school) • Proper way to do bibliography/reference page • Passive voice • Degree of formality in writing letters • Resume and employment letter • Website accuracy • How to properly write a manual • Tricks/methods of writing memos • Citations (Chicago, IEEE) • Have workshops (e.g., how to write a business letter) • Write better lab reports • Become a better presenter • Learn different writing styles • Balance images and writing • Improve writing(transitions, more fluid sentences. Better punctuation and vocabulary) • When to use footnotes • What to include in a proposal • Visual aids • How to do annotations • How to do collaborative writing • How to capture the reader better • How to correctly format • How to evaluate a paper • How to write a technical paper for a lay audience
Relevant Program Outcomes:	(d) an ability to function on multi-disciplinary teams. (f) an understanding of professional and ethical responsibility. (g) an ability to communicate effectively. (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. (i) an ability to engage in independent learning and recognize the need for continual professional development.
Required or Elective:	Required
Criterion 5:	General Education
Prepared By:	Alicia Jones Updated: 05/25/2016

Other

OREGON INSTITUTE OF TECHNOLOGY

Manufacturing and Mechanical Engineering and Technology

MET 160 *Engineering Materials I*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering
Bachelor of Science in Manufacturing Engineering
Bachelor of Science in Manufacturing Engineering Technology

DESCRIPTION:

Survey of materials used in industry and their physical and chemical principles as they relate to structure, properties, corrosion, and engineering applications. Major consideration given to metals alloys. Introduction to polymers, ceramics and composites included.

PREREQUISITES:

CHE 101/104 Elementary Chemistry and Laboratory or
CHE 201/204 General Chemistry and Laboratory

TEXTBOOK:

Required: Materials Science and Engineering: An Introduction
9th edition, Callister, Wiley

COURSE LEARNING OUTCOMES:

Upon completion of this course students should be able to:

1. The student will be able to perform calculations relating atomic radii, lattice parameters, and density when given the metal crystal structure.
2. Given system parameters the student will be able to determine the effect of time and temperature on solid state diffusion.
3. Given elastic stress/strain data the student will be able to determine mechanical properties of a material such as elastic modulus, yield strength and tensile strength.
4. Given an optical image of a failed surface the student will be able to determine the failure process (ductile or brittle).
5. Given the impact energy versus temperature of a low-carbon steel the student will be able to determine the ductile-to-brittle transition temperature.
6. Given the stress amplitude to number of cycles to failure for a steel sample the student will be able to determine the fatigue limit and fatigue life.
7. The student will be able to identify three stages of creep for a typical creep curve.

8. Given a binary phase diagram the student will be able to determine the phases present, the compositions of each phase, and the weight percent (amount) of each phase.

9. Given a time-temperature-transformation diagram for an eutectoid steel the student will be able to predict the microstructural development for a specified time temperature sequence.

TOPICS COVERED:

Types of Materials (Chapter 1)
Atomic Structure (Chapter 2)
Structure of Crystalline Solids (Chapter 3)
Imperfections in Solids (Chapter 4)
Solid State Diffusion (Chapter 5)
Unit Exam
Mechanical Properties (Chapter 6)
Dislocations and Strengthening Mechanisms (Chapter 7)
Failure (Chapter 8)
Unit Exam
Phase Diagrams (Chapter 9)
Phase Transformation in Metals (Chapter 10)
Processing of Metal Alloys (Chapter 11)
Unit or Final Exam

SCHEDULE:
Two 50 minute lectures/week over a 10 week term
One 3 hour laboratory/week over a 10 week term
Credits: Three quarter-based term credits (2-3-3)

PROGRAM OUTCOMES:
This course contributes to the following ABET-EAC Program Outcomes:

- an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a)
- an ability to design and conduct experiments, as well as to analyze and interpret data (b)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k)

PREPARER:
Josh T Millard
Dept. of MMET
05/17/2016

OREGON INSTITUTE OF TECHNOLOGY
Mechanical and Manufacturing Engineering and Technology

MET 241 - *CAD for Mechanical Design I*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
Computer aided drafting (CAD) for mechanical design. The focus of this course is the construction of 2-D drawings using current industry software. Topics include construction principles, input schemes, command structures, and data management.

PREREQUISITES:
ENGR 111 – MMET Orientation

TEXTBOOK:
Principles and Practice: An Integrated Approach to Engineering Graphics and AutoCAD 2016, Randy H. Shih, SDC Publications, 2015. ISBN: 978-1-58503-953-1

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should attain the following objectives:

- Use appropriate file management practices for AutoCAD and related software at a beginner level.
- Master basic AutoCAD 2D command streams and demonstrate increased proficiency.
- Reproduce sketches and drawings using accurate geometric construction and editing techniques in AutoCAD.
- Develop AutoCAD drawings for plot, using ANSI standard or other generally accepted industry practices.

TOPICS COVERED:

Reading, interpreting and preparing orthographic projection, isometric, and oblique drawings of individual objects. Applying dimensioning principles to provide size and location information to orthographic drawings, especially scale, text, general layout and content, effective use of layers and dimensioning techniques, symmetrical features, etc. Reading and preparing industry-standard contractual prints.

SCHEDULE:
Lectures: One 50-minute lecture per week over a 10-week academic term.

Lab: One 3-hour lab per week over a 10-week academic term.
Credits: Two quarter-based term credits (1-3-2).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have the ability to communicate effectively. (g)
- Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

PREPARER:

Irina Demeshko
Associate Professor, MMET Department
September 14, 2015

OREGON INSTITUTE OF TECHNOLOGY
Mechanical and Manufacturing Engineering and Technology

MET 242 - *CAD for Mechanical Design II*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Computer aided drafting (CAD) for mechanical design. The focus of this course is the construction of 2-D drawings using current industry software. Topics include detail part drawings, assembly drawings, and an introduction to 3-D drafting.

PREREQUISITES:

MET 241 - CAD for Mechanical Design I

TEXTBOOK:

Principles and Practice: An Integrated Approach to Engineering Graphics and AutoCAD 2016, Randy H. Shih, SDC Publications, 2015. ISBN: 978-1-58503-953-1

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should attain the following objectives:

- Use appropriate file management practices for AutoCAD and related software.
- Master basic AutoCAD 2D command streams and demonstrate increased proficiency during the course.
- Reproduce sketches and drawings using accurate geometric construction and editing techniques in AutoCAD.
- Develop AutoCAD drawings for plot, using ANSI standard or other generally accepted industry practices, especially scale, text, general layout and content, effective use of layers and dimensioning techniques.
- Plot drawings to scale.

TOPICS COVERED:

- Dimensioning and Notes
- Tolerancing and Fits
- Auxiliary Views
- Section Views
- Threads and Fasteners
- Symmetrical Features in Designs
- Assembly Drawings
- Project

SCHEDULE:

Lectures: One 50-minute lecture per week over a 10-week academic term.
Lab: One 3-hour lab per week over a 10-week academic term.
Credits: Two quarter-based term credits (1-3-2).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have the ability to communicate effectively. (g)
- Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

PREPARER:

Anne Marie Riechmann
Adjunct Faculty, MMET Department
December 15, 2015

MET 326 – *Electric Power Systems*

SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Study related to theory and application of industrial electric power systems. Topics covered include transformers, motors, generators, motor controls, and protective devices

PREREQUISITES:

ENGR 236: Fundamentals of Electric Circuits or EE 223: Elect Circuits II

TEXTBOOK:

Electric Power and Controls, 2nd edition, by Skarvenina & DeWitt,
Pearson Education Inc., 2004. ISBN: 9780131130456

COURSE LEARNING OUTCOMES:

Upon completion of this course students should be able to:

1. Identify and select control input and output devices such as switches and pilot lights
2. Explain the operation of relays
3. Explain the operation, sizing, and calculation of current and voltage on the secondary windings of transformers
4. Explain the theory of operation, selection criteria, and performance of 3 phase induction motors
5. Design, draw a schematic and select components for an "across the line" motor starter for a 3 phase induction motor that complies with the National Electric Code
6. Explain the types, theory of operation, selection criteria, and performance of single phase induction motors
7. Explain the types, theory of operation, selection criteria, and performance of DC motors
8. Explain how speed control is accomplished for 3 phase induction and DC motors

TOPICS COVERED:

- Single & Three Phase Power
- Magnetism
- Solenoids, Relays, & Relay Circuits
- Transformers
- Basic Motor and Generator Theory of Operation
- Single and Three Phase Induction Motors
- DC Machines

SCHEDULE:

Lectures: Two 50-minute lectures per week over a 10-week academic term.
Lab: One 2 hour and 50 minute lab per week over a 10 week academic term.
Credits: Three quarter-based term credits (2-3-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a).
- Graduates should have an ability to design and conduct experiments, as well as to analyze and interpret data (b).
- Graduates should have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).
- Graduates should have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k).

PREPARER:

Steve Edgeman
Assistant Professor, MMET
March 12, 2016

OREGON INSTITUTE OF TECHNOLOGY

Mechanical and Manufacturing Engineering and Technology

MET 375 Solid Modeling
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Mechanical Engineering

DESCRIPTION:
This course is an introduction to Solid Modeling techniques as applied to mechanical design. Topics include extruded and swept shapes, Boolean operations and other construction techniques.

PREREQUISITES:
MET 242 CAD for Mechanical Design II

TEXTBOOK:
Parametric Modeling with Creo, Shih, SDC Publications

COURSE LEARNING OUTCOMES:
Upon completion of this course students should be able to:

13. Be familiar with the terminology used in solid modeling and parametric modeling.
14. Identify the significant benefits of using solid modeling as a design tool.
15. Produce accurate and adequate engineering models.
16. Produce accurate engineering drawings for manufacturing.
17. Apply the modeling techniques taught to develop, and refine models.
18. Apply the software taught to problems in follow-on courses.

TOPICS COVERED:

- Introduction
  - Overview of 3-D modeling
- 3D Solid modeling package in use
  - System structure and user interface
  - Boolean operation and Solid Primitives
  - Basic Editing
  - Parametric Modeling
  - Symmetrical features in designs
- 2-D drawings from 3-D solids
  - 3-D annotations
  - 2-D Drawing layouts
  - Dimensioning
  - Title Block and Notes
- Assembly Modeling
  - Assembly Modeling methodology

- Tree structure
- Assembly Constraints
- Motion analysis and Animations

SCHEDULE:

2 - 50 minute lectures/week over a 10 week term
3 term credits (3-2-3)

PROGRAM OUTCOMES:

This course contributes to the following Program Outcomes. These outcomes align with the EAC a-k outcomes.

c. Graduates should be able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
g. Graduates should have the ability to communicate effectively.
k. Graduates should be able to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PREPARER:

Randy Shih
Professor, MMET
March 25, 2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MFG 103 – *Introductory Welding Processes*
SYLLABUS

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

Applications of welding in modern industry. Topics include: Oxyacetylene welding and cutting, shielded metal arc welding, gas tungsten arc welding, gas metal arc welding, and robotic welding.

PREREQUISITES: None

TEXTBOOK:

Welding Principles and Applications, 7th Edition by Jeffus, Delmar Learning, 2011.
ISBN: 978-1111039172

COURSE LEARNING OUTCOMES:

Upon completion of this course, students should be able to:

- Prepare for, analyze and answer questions pertaining to welding processes and applications.
- Communicate effectively in oral and written form.
- Develop team work skills and will learn how to interact with the instructor(s) and co-workers in compliance with the norms set by industry.
- Demonstrate that they have learned the welding processes and applications necessary to successfully complete this course.

TOPICS COVERED:

- Introduction and Safety
- Oxyacetylene Welding and Cutting
- Shielded Metal Arc Welding
- Gas Tungsten Arc Welding
- Gas Metal Arc Welding
- Metal Cutting Processes
- Robotic Welding.

SCHEDULE:

Lectures: Two 50-minute lectures per week over a 10-week academic term.

Lab: One 2 hour and 50 minute lab per week over a 10 week academic term.
Credits: Three quarter-based term credits (2-3-3).

PROGRAM OUTCOMES:

This course contributes to the following ABET – EAC Program Outcomes:

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a).
- Graduates should have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (c).
- Graduates should have an ability to function on multidisciplinary teams (d).
- Graduates should have an ability to identify, formulate, and solve engineering problems (e).
- Graduates should have an ability to communicate effectively (g).
- Graduates should have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k).

PREPARER:

Steve Edgeman
Assistant Professor, MMET Department
03/12/2016

OREGON INSTITUTE OF TECHNOLOGY
Manufacturing and Mechanical Engineering and Technology

MFG 120 – *Manufacturing Processes I*
SYLLABUS

REQUIRED/ELECTIVE FOR:
Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:
An introductory course in metal removal processes emphasizing drilling, milling, and lathe processes. Includes tool bit grinding. Emphasis on production speeds and feeds.

PREREQUISITES:
ENGR 111 – MMET Orientation
MATH 100 – Intermediate Algebra

TEXTBOOK:
Machine Tool Practices, Tenth Edition, by Kibbe, Meyer, Neely and White, Pearson Education Inc., 2015. ISBN: 9780132912655

COURSE LEARNING OUTCOMES:
Upon completion of this course, students should be able to:

- Understand the principles and application of machine shop safety.
- Develop theoretical and practical tools for machining operations.
- Demonstrate skills in the use of machine shop tools and equipment.
- Make decisions related to layout, processes and tooling.
- Operate and interpret common measuring instruments and tools.
- Demonstrate gained knowledge and skills in the production of laboratory projects.

TOPICS COVERED:
- Introduction and Safety
- Grinding Abrasives and Machines
- Lathe/Turning Machines
- Sawing Machines and Saw Blade Cutting/Welding
- Layout and Measurement
- Drilling Machines
- Turning Machines
- Milling Machines

SCHEDULE:
Lectures: Two 50-minute lectures per week over a 10-week academic term.

Labs: Three 1 hour and 50 minute labs per week over a 10 week academic term.
Credits: Four quarter-based term credits (2-6-4).

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes:

- Graduates should have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k).

PREPARER:

Steve Edgeman
Assistant Professor, MMET Department
03/12/2016

OREGON INSTITUTE OF TECHNOLOGY

Manufacturing and Mechanical Engineering and Technology

MFG314 *Geometric Dimensioning and Tolerancing*

REQUIRED/ELECTIVE FOR:

Required: Bachelor of Science in Mechanical Engineering

DESCRIPTION:

This course will introduce the ANSI and ISO geometric dimensioning and tolerancing principles and practices relative to product design and manufacturing operations (including datum, material condition symbols, tolerances of form and profile, tolerances of orientation and runout, location tolerances). The students should reinforce their learning by group discussions, class presentations, quizzes, and homework assignments.

PREREQUISITES:

MATH 112 and MET 242

TEXTBOOK:

Required: *Geometric Dimensioning and Tolerancing* by David A. Madsen (2013), published by the Goodheart-Willcox Company, Inc., ISBN: 978-1-60525-938-3

COURSE LEARNING OUTCOMES:

The goal of this course is to prepare students to be mechanical and manufacturing engineers. After successfully completing the course the students are expected to:

- Understand the fundamental terms, definitions and concepts related to geometric dimensioning and tolerancing.
- Identify and utilize geometric dimensioning and feature control on simple drawings.
- Obtain hands-on experience in measuring tolerances with some simple parts.
- Participate and function in team environments.
- Communicate effectively in a professional role with specific capability to present technical materials effectively.

TOPICS COVERED:

- Proper dimensioning techniques
- Datums
- GD&T symbols and terms
- Material Condition and Material Boundary
- Form Tolerances
- Orientation tolerances
- Location tolerances and virtual condition

- Profile tolerances
- Runout tolerances

SCHEDULE:

Two 50 minute lecture/week over a 10 week term
One 2 hour lab/week over a 10 week term
Credits: Three quarter-based term credits (2-1-2)

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes,

- Graduates should have an ability to analyze and model physical systems or components using (apply knowledge of) mathematics (including multi-variable calculus and differential equations), basic science and engineering (a).
- Graduates should be able to identify, analyze and solve engineering problems (e)
- Graduates should have the ability to communicate effectively (g)

PREPARER:

Yanqing Gao
Dept. of MMET
04/19/2016

OREGON INSTITUTE OF TECHNOLOGY

MGT 345 Engineering Economy
Credit and Contact Hours: 3-3
Instructor: Richard Bailey

Textbook and/or Resources
Newnan, Lavelle, & Eschenbach, *Engineering Economic Analysis*, 11th Edition, Oxford University Press, 2012.

SPECIFIC COURSE INFORMATION

Catalog Description

Capital expenditure, economic life and replacement analysis based on net present value, periodic costs, internal and incremental rates of return. Coverage of compound interest, value flows, economic equivalences, depreciation, taxes and inflation.

Prerequisite: MATH 105 or MATH 111
Required Elective

SPECIFIC GOALS OF COURSE

OUTCOMES:

This is a "tools and methods" course providing students with an understanding of financial analysis and decision-making. Since most industrial projects involve cash inflows and outflows spread over months or years, it is critically important to be able to understand the impact of interest rates, compounding frequencies, and the effects of timing differences of cash flows when comparing alternatives. This course is intended to provide students with the tools and skills needed to make these assessments and determine the "best" solution to simple and complex financial problems.

Topics:
time value of money
present and future worth analysis
single payment vs. multiple payment problems
annual cash flow analysis
nominal, real, and effective interest rates
break-even analysis
benefit/cost ratios
depreciation and sunk costs
the effects of taxes on economic decision-making

PROGRAM OUTCOMES:

This course contributes to the following ABET-EAC Program Outcomes,

- Graduates should have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (h)

Prepared by:

Richard Bailey
Professor, Management
Spring 2016

Appendix B – Faculty Vitae

Name: Abdelouahab Abrous Fall 2015

Department: Manufacturing and Mechanical Engineering & Technology

Academic Rank: Associate Professor

Year of OIT Employment: 2015 **Years of Service:** 1

Academic Degrees

Ph.D., Mechanical Engineering, University of Washington (1988)
M.S., Engineering, University of Washington (1984)
B.S., Physics, University of Science & Technology, Algiers, Algeria (1981)

Professional Licenses and Certificates

Professional Engineer, State of Washington, 1997
Professional Engineer, State of Oregon, 2008
Professional Engineer, State of Idaho, 2010
Professional Engineer, State of California, 2013

Academic Experience

Associate Professor & Co-Program Director, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Seattle Program.	2015-Present
Associate Professor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Seattle Program.	2014-2015
Adjunct Professor of Mechanical Engineering, Oregon Institute of Technology, Seattle Program.	2007-2014
Coordinator for Science, Mathematics, and Engineering Courses, Henry Cogswell College, Everett, WA.	2000-2006
Acting Dean of the School of Engineering and Science, Henry Cogswell College, Everett, WA.	2004-2006
Professor of Mechanical Engineering, Henry Cogswell College, Everett, WA.	2005-2006
Associate Professor of Mechanical Engineering, Henry Cogswell College, Everett, WA.	2001-2005
Assistant Professor of Mechanical Engineering, Henry Cogswell College, Everett, WA.	2000-2001

Professional Experience, Consulting, Patents

Consultant in Forensic Engineering, Seattle, WA. 1990-Present

Design Engineer & Structural Analyst, HiLine Homes, Puyallup, WA. 2007-Present

Principal Publications (last five years only)

Scientific and Professional Society Memberships (current only)

American Society of Mechanical Engineers (ASME)
American Society for Engineering Education (ASEE)
International Code Council (ICC)

Institutional and Professional Service:

Student advisor

Participate in recruiting students through OIT meet and greet events

Co-program director for Seattle program

Serve in search committee for Seattle program director position

Professional Development Activities (last five years only)

Attended workshop on "IBC 2012 Wind, Seismic, and Anchorage Design, SFM and the New Yield-Link" at Simpson Headquarters in Kent, WA.	5/7/2013
Attended workshop on building sciences offered by ProBuild ProEarth University team in Denver, CO.	4/24/2012-4/27/2012
Attended workshop on "Building Science 101" offered by ProBuild in Portland, OR.	6/3/2011
Attended all-day workshop on "General Construction Review" at Simpson Headquarters in Kent, WA.	10/14/2011

Name: Eyal Arian, Ph.D. Spring 2016

Year of OIT Employment: 2009 **Years of Service:** 6

Background: Applied Mathematician with over 20 years of professional experience in mathematical modeling and algorithm development for the solution of large-scale problems in aerospace applications at NASA, Boeing, and as a university professor.

Academic Degrees:

Ph.D., Applied Mathematics (numerical analysis), The Weizmann Institute of Science, 1994
M.Sc. Theoretical Solid State Physics, Tel-Aviv University, 1989
B.S., Physics and Mathematics, The Hebrew University of Jerusalem, 1986

Academic Experience:

2009-Present Adjunct Professor of Mechanical and Manufacturing Engineering Technology, Oregon Institute of Technology, OIT-Boeing Program
1999 -2001 Assistant Professor, Mathematics Department, Ohio University, Athens, OH.

Teaching Experience:

Computer Programming for Engineers (ENGR 266), Numerical methods (Math 451), Linear Algebra (Math 341), Vector Calculus (Math 254N), Data Analysis for Engineers (MFG597).

Professional Experience:

Full-time industrial experience:
2001 -2014 Math and Modeling Associate Technical Fellow, The Boeing Company
1994 -1999 Staff Scientist, ICASE, NASA Langley Research Center, Hampton, VA.

Founder: OptiSolve
Development of algorithms for the solution of optimal resource allocation, optimal scheduling and optimal routing problems.

Selected Publications:

2014 David P. Young, Robin G. Melvin, William P. Huffman, Eyal Arian, Moeljo Hong, and Mark Drela, "Implementation of a Separated Flow Capability in TRANAIR," AIAA Journal, (2014).
2011 Telib H., Arian E., and Iollo A., *The effect of shocks on second order sensitivities for the quasi-one-dimensional Euler equations*, Journal of Computational Physics, Vol. 230, Issue 23, pp.8603-8618 (2011).
2010 Arian E. and Iollo A., *Challenges in aerodynamic optimization*, M Hafez, K. Oshima, D. Kwak (Eds.), Computational Fluid Dynamics Review 2010, World Scientific, 2010, pp. 447–467 (2010).

Name: John W. Bridge Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Adjunct Professor

Year of OIT Employment: 4.5 **Years of Service: 4.5**

Academic Degrees

PhD in Materials Science and Engineering Interdisciplinary, University of Maine, 2010
MS in Materials Engineering, University of Maine, 1985
BS in Engineering Mechanics, U.S. Air Force Academy, 1982

Professional Licenses and Certificates

Licensed Professional Engineer (P.E.), State of Maine (License #10359), Maine

Academic Experience

Oregon Institute of Technology, Mechanical Engineering, 2014-present, part time
University of Washington Bothell**,** Associate Professor, Sept. 2014 – present, full time
Oregon Institute of Technology, Mechanical Engineering, 2011-2014, full time
Maine Maritime Academy, Marine Systems Engineering, 2006-2011, full time
United States Military Academy, Civil & Mechanical Engineering, 1998-2002, full time
Bowdoin College, Physics, 2003-2006, full time
Florida Institute of Technology, 1997-1998, part time
United States Air Force Academy, Engineering Mechanics, 1992-1996, full time

Professional Experience, Consulting, Patents

United States Air Force, mechanical engineering officer, 1982-2002, full time
Consultant, JB Engineering, 2003 to present, part time
Lawrence Livermore National Laboratory, research associate, 1986-1988, full time

Principal Publications (last five years only)

1. Bridge, J. W., Fisher, R., Weisshaupt, K., Dempsey, K., Peterson, M. L., "Analytical Methods to Determine Chemical Changes in High-Oil Paraffin Binders used in Granular Composites", Materials Today Proceedings, Sept 2015.

2. Bridge, J. W., Fisher, R., Lai, T, Peterson, M. L., "Comparison of Wax Extraction Methods used in Synthetic Granular Composite Sports Surfaces", Ceramic Transactions, ACerS, Mar 2014.

3. Bridge, J. W., Mahaffey, C.A. and Peterson, M. L., "Analytical Test methods Used to Characterize Granular Composite Sport Surface Materials", Applied Mechanics and Materials Journal, 440, 74-81, 2014.

4. Bridge, J. W., Peterson, M. L., McIlwraith, C. W., "The Effect of Temperature on the Tangent Modulus of Granular Composite Sport Surfaces", Society of Experimental Mechanics Journal (Experimental Techniques), 7, (3), May/June 2013.

Scientific and Professional Society Memberships (current only)

- Member of the American Society of Engineering Education (ASEE)
- American Society for Materials (ASM)
- Society for Manufacturing Engineers

Honors and Awards

- The U.S. Military Academy (West Point), M.E. Division Teaching Award, 2002
- The U.S. Air Force Academy Outstanding Educator Award, 1997-1998

Institutional and Professional Service (last five years only)

- Coordinator, UWB Mechanical Engineering Program
- Chair, STEM ABET Engineering Program Accreditation (Computer, Mechanical, and Electrical)
- Chair, Mechanical Engineering ABET Accreditation
- Chair, MS Systems Engineering Degree Working Group
- Chair, Hiring Committee Mechanical/Systems Engineering Prof of Practice
- Member, UWB Graduate Leadership Council
- Member, STEM Physics Search
- Member, Engineering & Math RCEP Committee
- Technical Paper Reviewer
- Lab/Cor Laboratory Senior Materials Scientist
- Advisor for Catholic Student Union

Professional Development Activities (last five years only)

- ASME Mechanical Engineering Leadership Summit, ABET Workshop, Newport Beach, CA March 12-14, 2015
- Fundamentals of ABET Program Assessment Workshop, Seattle, WA Oct 18, 2014

Name: Irina Demeshko Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology (MMET)

Academic Rank: Associate Professor

Year of OIT Employment: 2007 **Years of OIT Service:** 9

Academic Degrees:

B.S., Civil Engineering, Far Eastern State Transport University, Russia (1995)

M.S., Civil Engineering, Far Eastern State Transport University, Russia (1996)

B.A., Business Economics, Far Eastern State Transport University, Russia (2001)

M.A., Economics, Far Eastern State Transport University, Russia (2002)

Professional Licenses and Certificates:

Licensed in Design and Re-construction of Railway Roads, Ministry of Transportation, Russia

Academic Experience:

2013 – Present	Associate Professor of Mechanical Engineering, Oregon Institute of Technology
2009-2013	Assistant Professor, Oregon Institute of Technology
2007-2009	Instructor, Oregon Institute of Technology
2006-2007	Adjunct, Oregon Institute of Technology
1998-2003	Assistant Professor, Far Eastern State Transport University, Russia
1996-1998	Instructor, Far Eastern State Transport University, Russia

Industry Experience:

Part-time experience:

1996-2001 Engineer, Far Eastern Railway Company, Russia

Research Experience:

1995 – 1996 Graduate Research Assistant, Far Eastern State Transport University, Russia

Principal Publications and Presentations (last five years only):

2015, 2014, 2013, 2012, 2011 Demeshko-Prosnik, I., "Using Inventor Software", OIT

2014 Presented at the 49th NAWI (National Association for Workplace Improvement), Portland, OR.

2014 Developed and published resources for Advanced Aerospace Manufacturing Education Project funded by NSF grant.

2011 Demeshko-Prosnik, I., Culler, D.E., Minster, M.K. "Proposing a Structured Graphical Model Using IDEF that can be Used for Storing, Organizing, and Studying Factors that Influence Girls and Young Women to Consider a Career in Engineering." Paper published and presented to ASEE conference in Vancouver, B.C., Canada

2011 Demeshko-Prosnik I., "Nontraditional Careers". Presented at Career & Job EXPO

Scientific and Professional Society Memberships (current only)

Member, American Society for Engineering Education (ASEE)
Member, Society of Women Engineers (SWE). Oregon Tech Faculty Advisor for SWE
Member, Society of Mechanical Engineers (SME)

Institutional and Professional Service (last five years only)

Faculty Advising Coordinator for the MMET department 2011 – present.
PLTW Affiliate Professor, 2008 – present.
Advising over 40 MET/ME/MFG students.
Faculty Advisor for SWE (Society of Women Engineers) club 2007 – present.
MMET Search Committee member (multiple committees).
MMET Post-Tenure Review Committee chair (multiple committees).
MMET Promotion Review Committee member and chair.
Member of the Advising Coordinator Commission (ACC) 2013 – present.
Member of the Faculty Senate Appeals Committee 2014 – present.
Member of Affirmative Action Commission 2012-2015.
Member of Student Hearing Commission 2011-2013.
Member of Curriculum Planning Committee 2010-2012.
ETM reader for the OTF Scholarships 2011 – present.
Represent MMET department during Spring Preview Day, Fall Preview Day, Tech Trek.
Career Technical Education Advisory Committee (Southern Oregon Education Service District)

Professional Development Activities (last five years only)

Completed online workshops in Creo 3.0 (Solid Modeling program). The software has annual updates.
Completed annual training in Inventor (Solid Modeling program). The software has annual updates.
Took online courses to develop skills and knowledge related to Camtasia Studio.
Taking online courses related to rapid prototyping, specifically 3D printing.
Attended WomenTech Educators Webinars.
Developed resources for Advanced Aerospace Manufacturing Education Project.
Attended Engineering Ambassadors Workshop in Corvallis, OR.
Attended the 3-day Project Lead the Way Planning Session 2011, 2012, and 2013.
Project Lead the Way Affiliate Professor for Intro to Engineering, taught core curriculum at summer training for the last 8 years.

Name: Haftom Dessalegn Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Technical Principal Investigator (BAC Product Development)

Year of OIT Employment: 2 yrs **Years of Service:** 7 yrs

Academic Degrees: M.S. Manufacturing Engineering and B.S. Aerospace Engineering and Mechanics

Professional Licenses and Certificates: Advance TRIZ Certificate

Academic Experience: 2 yrs

Professional Experience, Consulting, Patents: 7 yrs at Boeing as Product Development Engineer

Principal Publications (last five years only): none

Scientific and Professional Society Memberships (current only): AIAA

Honors and Awards: Engineer of the Year 3rd place (BCA Product Development, 2015)

Institutional and Professional Service (last five years only): none

Professional Development Activities (last five years only): Boeing Future Leaders 2016

Name: Steve E. Edgeman Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank: Assistant Professor

Year of OIT Employment: 2003 **Years of Service:** 10

Academic Degrees:

M.S., Manufacturing Engineering Technology, Oregon Tech (2012)
B.S., Manufacturing Engineering Technology, Oregon Institute of Technology (2003)

Professional Licenses and Certificates:

Fanuc Robotics Certified Instructor (CERT), 2013

Academic Experience:

2014 – Present	Assistant Professor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Tech, Klamath Falls, OR.
2012 – 2014	Instructor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Tech, Klamath Falls, OR.
2010 – 2012	Adjunct Faculty, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Klamath Falls, OR.
2006 – 2007	Instructor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Klamath Falls, OR.
2003 – 2006	Teaching Assistant, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Klamath Falls, OR.

Professional Experience:

2008 – 2009	Owner/Manager: Licensed Firearms Restoration, Repair, Parts Mfg. and Fabrication, La Pine, OR.
1998 – 1999	Assistant Manager/Inventory Control, Fred Meyer, Klamath Falls, OR.
1994 – 1998	Manager/Inventory Control, CSK Auto Corp., Albany, OR.
1982 – 1994	Owner/Manager: Licensed Firearms Restoration, Repair, Parts Mfg. and Fabrication, Sacramento, CA.
1983 – 1985	Plastics Mechanic/ Machinist, Aerojet General Corp., Rancho Cordova, CA.
1980 – 1983	Owner/Electrician, Central Valley Builders, Sacramento, CA.
1976 – 1981	Manager/Auto Technician, Goodyear Tire and Rubber Co., Sacramento, CA.

Institutional and Professional Service:

- Co-PI for NITC/Oregon BEST/KersTech Grant: Generalized Adaptation of an Electric-Hydraulic hybrid drive system, 2014 – 2015.
- Curriculum Planning Commission, 2014 – Present.
- B.S.Manufacturing Engineering Technology Program Director, Curriculum Coordinator, and Assessment Coordinator, 2014 – Present.

Institutional and Professional Service (cont.):

- Equipment Fund Proposal, $38,125 awarded, 2015.
- Equipment Fund Proposal, $37,311 awarded, 2013.
- Serve as an academic advisor for students enrolled in MMET degree programs.
- Supervise graduate teaching assistants and manage associated equipment.
- Attend Fall/Spring Term Industry Advisory Council (IAC) meetings.
- MECH/MET 363 Instrumentation Laboratory Coordination.
- Maintain equipment for the MMET Electric Power Systems and Instrumentation Labs.
- Maintain equipment (Fanuc Robots) for the MMET Automation & Robotics Laboratory.
- Careers in Gear Youth Success Expo, 2013.
- Master's Project chosen with student benefits as a primary consideration.
- Resource Budget Commission Proposal, $5720 awarded, 2012.
- Participate in Tech-Trek, Preview Day, OIT Open House, Family Weekend, Orientation, and other Student Affairs events.
- Participation in the Redmond Advanced Manufacturing Career and Technical Education initiative.

Professional Development Activities (last five years only):

- DigiTEC Microcontroller Workshop, 2014
- Academic Advisor Training, Winter 2013.
- M.S., Manufacturing Engineering Technology, Oregon Tech, 2012.
- FANUC Robotics Certified Education Robot Training (CERT) program (50 hrs.), 2013.
- CEU (O.U.S.): Professional development training sessions, 2011.
- All OIT Convocation sessions/seminars potentially beneficial to my professional development.

Name: Melissa Estelle Spring 2016

Department:

Academic Rank and Title:

Year of OIT Employment: 2014 **Years of Service:** 2

Academic Degrees: M.A. University of Wales, Lampeter, UK, B.A. The Evergreen State College, and B.A. Michigan State University.

Academic Experience: 11 years of teaching at the college/university levels.

Honors and Awards: *Excellence in Teaching, Learning and Service* from Cascadia Community College, and *Excellence in Teaching* from the National Association of Students.

Institutional and Professional Service (last five years only):
Numerous committees and workgroups at other colleges.

Professional Development Activities (last five years only): Annual FERPA workshops, Cultural Competency/Anti-oppression workshops, Student Success workshops, etc.

Name Yanqing Gao

Department Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title Associate professor

Year of OIT Employment: 2013 **Years of Service:** 3

Academic Degrees

Ph.D., Mining and Geological Engineering, The University of Arizona, Tucson, Arizona 2010
M.S., Industrial Engineering, The University of Arizona, Tucson, Arizona 2001
M.S., Mechanical Engineering, Southern Illinois University, Illinois 2000

Academic Experience

2013-present Associate professor, Oregon Institute of Technology
2012-2013 Visiting assistant professor, Indiana University Purdue University Indianapolis
2011-2012 Adjunct Assistant Professor, University of Arizona
2008-2011 Research Engineer, University of Arizona

Professional Experience

Full-time professional experience:
2008-2011 Research Engineer, University of Arizona
2006-2008 Instructor, University of Arizona
1982-1998 Engineer, Senior Engineer, Chinese Academy Sciences
Part-time work experience:
2000-2006 Graduate Research Assistant, University of Arizona
1998-2000 Graduate Teaching Assistant, Southern Illinois University

Consulting, Patents, grants, etc.

- “Toyota” project at Transportation Active Safety Institute (TASI), Indiana Purdue University Indianapolis
- PARCS project at University of Arizona

Professional Licenses and Certificates

Pressure Vessel Design License 1986

Principle Publications (last 5 years)

Book

1. Yanqing Gao, Fei-Yue Wang and Zhiquan Xiao, “Flexible Manipulators: Modeling, Analysis and Optimum Designs”, Elsevier, April 2012, ISBN: 978-0-12-397036-7.

Papers

1. Y.Q Gao, F.Y. Wang, etc., “A Social Manufacturing Laboratory for CDIO Education of CPSS-based Production and Operation”, final paper accepted by 2016 ASEE Annual Conference.
2. Sun, W.P., Gao, Y.Q., 2015, “Teaching statistical quality control by applying control charts in the catapult shooting experiments,” June 2015 ASEE Annual Conference & Exposition.
3. Jianping Cao, Ke Zeng, Hui Wang, Jiajun Cheng, Fengcai Qiao, Ding Wen, Yanqing Gao: Web-Based Traffic Sentiment Analysis: Methods and Applications. IEEE Transactions on Intelligent Transportation Systems 15(2): 844-853 (2014)
4. Fei-Yue Wang, Daniel Zeng, James A. Hendler, Qingpeng Zhang, Zhuo Feng, Yanqing Gao, Hui Wang and Gregory G. Lai, A Study of The human flesh Search engine: crowd-Powered expansion of online Knowledge, Computer by IEEE computer Society, August 2010, pp45-53.

Scientific and Professional Societies

ASEE, IEEE member

Institutional and Professional Services (last 5 years)

- Chair, ASME MESA Technical Committee, 2014-2015
- Associate Editor of the IEEE Transactions on Intelligent Transportation Systems, 2014 to present
- **Conference General Chair of IEEE/ASME Mechatronic and Embedded Systems and Applications, Senigallia - Ancona – Italy, September 10-12 2014**
- Conference Finance Chair of IEEE Intelligent Vehicles Symposium, Michigan, June 8-11 2014
- Conference Program Chair of IEEE/ASME Mechatronic and Embedded Systems and Applications, August 2013
- Conference Finance Chair of 9th IEEE International Conference on Networking, Sensing and Control, Beijing, China, April 11-14 2012
- Conference Finance Chair of IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications, Suzhou, China, July 8-10 2012
- Conference Finance Chair of IEEE International Conference on Service Operations and Logistics, and Informatics, Suzhou, China, July 08-10 2012
- Conference Finance Chair of IEEE International Conference on Vehicular Electronics and Safety, Beijing, China, July 10-11 2011
- Conference Finance Chair of IEEE International Conference on Service Operations and Logistics, and Informatics, Beijing, China, July 10-12 2011
- Conference Finance Chair of IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications, Qingdao, China, July 15-17 2010
- Conference Finance Chair of IEEE International Conference on Service Operations and Logistics, and Informatics, Qingdao, China, July 15-17 2010
- Conference Finance Chair of IEEE International Conference on Vehicular Electronics and Safety, Qingdao, China, July 15-17 2010

Name: Jeffrey C. Hayen | Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology (MMET)

Academic Rank: Associate Professor

Year of OIT Employment: 2011 **Years of OIT Service:** 5

Academic Degrees:

- Ph.D. Applied Mechanics and Physics, California Institute of Technology (1996)
- M.S. Mechanical Engineering, San Diego State University (1986)
- B.S. Mechanical Engineering, San Diego State University (1984)

Academic Experience:

- 2011 – Present Associate Professor of Mechanical Engineering, Oregon Institute of Technology
- 1995 – 2011 Professor of Engineering/Mathematics/Physics, Southwestern Oregon Community College
- 1991 – 1995 Graduate Teaching Assistant, California Institute of Technology
- 1984 – 1986 Graduate Teaching Assistant, San Diego State University

Industry Experience:

- 2010 – Present Aerospace/Consulting Engineer, United Launch Alliance (Lockheed-Martin and Boeing Co.)
- 2006 – 2008 Mechanical/Consulting Engineer, Civil West Engineering Services, Inc.
- 1986 – 1990 Aerospace/Mechanical Engineer, General Dynamics Corporation (Space Systems Division)

Research Experience:

- 1996 – 2000 Research/Consulting Engineer, California Institute of Technology and Kajima Corporation
- 1990 – 1992 Graduate Research Assistant, California Institute of Technology (Keck Hydraulics Lab.)

Principal Publications:

- 2005 "Brachistochrone with Coulomb Friction",
  International Journal of Non-Linear Mechanics, Vol. 40, No. 8, pp. 1057–1075
- 2003 "Projectile Motion in a Resistant Medium Part I: Exact Solution and Properties",
  International Journal of Non-Linear Mechanics, Vol. 38, No. 3, pp. 357–369
- 2003 "Projectile Motion in a Resistant Medium Part II: Approximate Solution and Estimates",
  International Journal of Non-Linear Mechanics, Vol. 38, No. 3, pp. 371–380

2000 Realistic Model Studies of Active Interaction Control (with Emeritus Professor Wilfred D. Iwan),
Earthquake Engineering Research Laboratory Report No. 2000-03, California Institute of Technology

Conference Presentations:

2005 "Projectile Motion in a Resistant Medium: The Cubic Law",
Oregon Mathematical Association of Two-Year Colleges, (Lincoln City, OR) April 2005

2007 "A Unified Approach to Exponentials, Radicals, and Logarithms: The Ruling Triumvirate",
Oregon Mathematical Association of Two-Year Colleges, (Lincoln City, OR) April 2007

2009 "The Kepler Problem in Orbital Mechanics: A Segue to Bessel Functions",
Oregon Mathematical Association of Two-Year Colleges, (Lincoln City, OR) April 2009

2011 "The Kepler Problem in Orbital Mechanics: Position and Speed as Functions of Time",
Oregon/Washington Two-Year College Mathematics Conference, (Stevenson, WA) April 2011

2013 "Trigonometric Treasures in Mechanical Engineering",
Oregon Mathematical Association of Two-Year Colleges, (Lincoln City, OR) April 2013

2015 "Analytical Assets in Mechanical Engineering: Lagrange's Equations of Motion",
Oregon Mathematical Association of Two-Year Colleges, (Lincoln City, OR) April 2015

2015 "Projectile Motion with Aerodynamic Drag: The Cubic Law",
ASEE Annual Conference and Exposition, (Seattle, WA) June 2015

Institutional Service:

- Served as an academic advisor for students enrolled in B.S. degree programs.
- Supervised graduate teaching assistants and managed associated equipment.
- Attended all Fall/Spring Term Industry Advisory Council (IAC) meetings.
- Served on standing committees dedicated to University Academic Affairs.
- Served on standing committees dedicated to University Academic Standards.
- Served on search committee to fill MMET department faculty positions.
- Served on search committee to fill MMET department support positions.
- Served as an institutional mentor for a new MMET department faculty member.
- Served as the MMET department chairperson (in Year 2 of a three-year appointment).

Professional Service:

- Served as a reviewer of research articles (for technical/archival journals).

- Served as a reviewer of conference articles.
- Served as a reviewer of higher-education textbooks.

Professional Affiliations:

- American Society of Mechanical Engineers
- American Society of Civil Engineers [Inactive]
- American Physical (Science) Society
- American Society for Engineering Education

Name: Michael D. Huffman Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Education:

Ph.D. (1980), M.S. (1977), Mathematics, California Institute of Technology

B.S. (1975), Summa Cum Laude with Distinction in Mathematics, University of New Mexico

Academic Experience:

2014 – Present: Instructor, Oregon Institute of Technology, Seattle Program

Have taught trigonometry and linear algebra thus far

1993-2001: Instructor, Green River Community College Department of Mathematics

Taught algebra, pre-calculus and calculus courses

1979-1986: Montana State University, Bozeman, MT

1979-86: Assistant Professor of Statistics, Department of Mathematical Sciences Taught graduate and undergraduate statistics courses. Received Alumni and Chamber of Commerce Award for Excellence in Education, 1982.

1983-86: Consultant, Agricultural Experiment Station. Consulting and instruction for faculty and students in multiple areas.

Author or co-author on a total of eight publications in refereed journals.

Non-Academic Experience

2008-Present: Applied Mathematician, Boeing Research and Technology

Consultation and methodology development in the areas of reliability analysis, forecasting, simulation, inventory planning and general statistical analysis.

Instructor in the Boeing Ed Wells program, team-teaching a 15-hour basic statistics class and a 16-hour design of experiments class.

2000-2008: Mathematics and Math Modeling, Boeing Material Management Organization

Primary duties included forecasting, inventory planning, statistical analysis and systems development.

1990-2000: Statistical Consultant, Boeing Commercial Airplane Group, Fabrication Division

Consultation and instruction on design of experiments, statistical process control, measurement system studies and general data collection and data analysis.

Advanced Quality System (AQS) certified instructor for the Boeing Fabrication Division.

1986-1990: Bear Creek Corporation, Medford, OR

Statistician and then manager in the marketing department.

Certifications: None

Professional Memberships

American Statistical Association

International Institute of Forecasters

Institute of Business Forecasting

Patents

U.S. Patent 8467978 awarded June 2013, titled "Identifying Features on a Surface of an Object Using Wavelet Analysis" with Alan Jones, Thomas Hogan, Andrew Booker and Bruce Andrews

Honors and Awards

Boeing Ed Wells Instructor Excellence Award, 2015, with Stephen P. Jones and Sabyasachi Basu

Boeing Associate Technical Fellow, 2000

Presentations

"Forecasting and Planning for Intermittent Demand", presented at the Institute of Business Forecasting Best Practices Conference, 2011.

Name: Tony Koung Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Adjunct Instructor

Year of OIT Employment: 2015 **Years of Service: 5 years at Boeing**

Academic Degrees

- Bachelor of Science, Aerospace Engineering minor Computer Aided Design/Computer Aided Manufacturing
- Masters of Science, Mechanical Engineering

Professional Licenses and Certificates

- Fundamental of Systems Engineering (Cal Tech)
- Aircraft Composite Materials & Manufacturing (UW)
- Product Life Cycle Management (Purdue)
- Lean Six Sigma Green Belt (Villanova)

Academic Experience
Embry-Riddle Aeronautical University, Graduate Teaching Assistant

Professional Experience, Consulting, Patents

Boeing, Structural Design Engineer

Principal Publications (last five years only)

A P-3 Deployable Unmanned Aircraft for Scientific Measurement of Tropical Cyclones

Scientific and Professional Society Memberships (current only)

None

Honors and Awards

None

Institutional and Professional Service (last five years only)
None

Professional Development Activities (last five years only)

- Conducting Airframe Rotation Program knowing how my job impacts our groups.
- Brainstorm new ideas that can innovate and help the company

- Going to the factory floor seeing how the airplane is put together

Name: Dongbin "Don" Lee

Education - degree, discipline, institution, year:

Ph.D. – Robotics Degree in ECE, Clemson University, 2009

M.S. – Robotics in School of Robotics (formerly, Control & Instrumentation Engineering), KwangWoon University, 2000

B.S. – ECE Engineering, KwangWoon University, 1992

Academic experience – institution, rank, title, dates, full or part time

Oregon Tech, MMET Dept, Assistant Professor, 2013 Fall - Present, FT

Villanova University, ME, CENDAC & CAC Centers, Research Associates, '09-'12, FT

Non-academic experience – company or entity, title, description, when, full/part time

Rogue Rovers, Adviser, Semi-autonomous Electric-ATV project, 9/2013-5/2014, PT

Microface, Senior Engineer, Research on Controls, 1999-2002, FT/PT

Ssangyong Motor&PIC, Engineer, Robotics & Automation Team in R&D, 1991-1997,FT

Certifications or professional registrations: Certification for FANUC Robotics (1) Material Handling Tool Operation & Programming, (2) V-iR Vision Operations & 2D Systems

Current membership in professional organizations

AUVSI (Association of Unmanned Vehicles Systems International), 2010 - present

Honors and awards

- Equipment Fund awardee 2013 for Renovation of Robotics Lab in CO117, Oregon Tech
- RBP awardee 2014 for a senior project, Water Purifier, proposed & led by Don Lee, OT
- RBP Award 2013 for a senior project, UAVARM, proposed and led as the adviser, OIT
- Dean's Dollars awardee 2013 for a senior project, Heat Tube, as the adviser, OIT
- Silver Medal w/$5,000.00, Villanova University Autonomous Surface Vehicle Student Team, led by Dr. Lee for "RoboBoat" International Competition, VA, June 2012
- Award for One of Best Engineers, from SsangYong Company, Inc. 1996

Service activities (within and outside of the institution)

Oregon TECH (OIT)

- General Education Subcommittee member, "Teamwork," Winter14, Fall'15 - Present
- Member of Quantitative Literacy in CCT, Oregon Tech, 2015 Fall - Present
- Committee member of MSMFG Graduate students, Hoe-Jin Kim ('14), Xiaoyue Zhang ('15), and Ayman Altirkistan ('14-Present)
- Faculty Adviser for AUVSI Club (Unmanned Vehicle Systems), 2015 Fall – Present
- Faculty Adviser for Oregon Tech Robotics Club (OTRC), 2013 Fall – June, 2015
- Director of Oregon Tech Robotics & Automation Lab in CO117, 2013 Fall - Present
- Mentor & Adviser of Regional Underwater Robotics Competition, MATE Ranger, 4/15
- PI of OregonBEST project (CG-SOW-2014-OIT-RR), partnered with Rogue Rovers, Inc., "Semi-autonomous All-Terrain Vehicle for Specialty Agriculture," 10/2013-4/2015
- PI of two senior projects, "Wind Energy Generation System," sponsored by eWindSolutions, Inc., (1) Tether System (2) Power Generation System, 2014 F-2015Sp
- Revamping Oregon Tech Robotics Lab, Oregon Tech, 2014 W – 2014 Sp
- Participation in Engineering Week, Oregon Tech, Feb, 2014
- Participation in First Robotics Competition (FRC) Kick-off, Oregon Tech, Jan. 2014
- Technical Reader of WRI227 students: Shawn Phinney (2013), Phillip Perkins (2013), Tyler Moreland (2014), Jack Markee (2015), and Edmund Samway (2015).

Outside -Book Editor, "Systems and Control of Nonlinear Equations," INTECH, 6/2015-Present

- Review Editor, Robotic Control Systems in Robotics and AI, Journal Frontier,5/'15-Pre.
- Review Editor, Mechatronics in Mechanical Engineering, Journal Frontier,6/'15-Present
- Book Editor Panel, Nonlinear Control of Robots & UAVs, CRC Press, 6/2015 - Present
- PI & Coordinator of "Unmanned Vehicle Demonstrators" of Autonomous Systems, ONR Projects (FY-07/-09) at Villanova University (VU), ME Dept & CENDAC, '10-'12
- Officer, Keystone Chapter of AUVSI Society, serving in mid-atlantic region, 2010-2013
- Mentor & Adviser of Villanova ASV Teams for RoboBoat Competition, 2010 - 2012
- Judge, MATE Underwater Robotics Competition, Philadelphia school dis., VU, '10-'12
- Co-chair for 2011 ASME DSCC, Washington DC, Co-chair for 2011 ACC, San Francisco, CA, and Acting Chair for 2010 ASME DSCC, Nonlinear Sys, Cambridge, MA
- Reviewer over 30 journal & conference papers including ASME/IEEE TAC/ISR, '05-Pr.

Briefly list the most important publications and presentations from the past five years – title, co-authors, where published and/or presented, date of publication or presentation

- Dongbin Lee and Timothy C. Burg, Lyapunov-based Control of Unmanned Aerial Vehicle Designed via Stability Analysis, Chapter 12 in Control Theory: Perspectives, Applications and Developments, Nova Science Publishers, ISBN: 978-1-63482-730-0
- Ravikiran B. Singapogu, Christopher C. Pagano, Timothy C. Burg, Paul G. Dorn, Ron Zacharia, Dongbin Lee, "Perceptually salient haptic rendering for enhancing kinesthetic perception in virtual environments," Journal of Multimodal User Interfaces, DOI 10.1007/s12193-014-0164-1, Sept. 2014, {doi: 10.1007/s12193-014-0164-1}
- Peng Xu, Ran Huang, Dongbin Lee, Timothy C. Burg, "Dynamics and Control of a Novel Manipulator on VTOL Aircraft System - a Planar Case Study," Proc. of American Control Conference, ThC03, Aircraft Flight Control II, June, 2014, Portland, Oregon (presenter too)
- Dongbin Lee "Adaptive and Robust Control of an Unmanned Surface Vessel," ASME 2013 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS 2013-3239), Sept. 16 ~ Sept. 18, Snowbird, Utah, 2013 (presenter too)
- Dongbin Lee, Timothy C. Burg, C. Nataraj Enver Tatlicioglu, and Vilas Chitrakaran,"Model-based 3D Position and Angle Tracking Control of Underactuated Unmanned Aerial Vehicle," Book Ch.15, Numerical Simulation, Academy Publish, June 2013
- Dongbin Lee and C. Nataraj, "Model-based Adaptive Tracking Control of Linear Time-varying System with Uncertainties," Book Chapter 2 – Numerical Simulation From Theory to Industry, ISBN 979-953-307-821-1, InTech, Sept. 2012
- Dongbin Lee, C. Nataraj, and Peiman Naseradinmousavi, "Nonlinear Dynamic Model-based Adaptive Control of A Solenoid-Valve System," Adaptive Control Theory and Applications, Journal of Control Science and Engineering, May, 2012
- Dongbin Lee, Timothy C. Burg, and C. Nataraj, "Coordinated Control of Flying robotic Arm," 2012 ASME Dynamic Systems and Control Conference (DSCC-8770), Robotics I, Ft. Lauderdale, FL, Oct. 17 ~ Oct. 19, 2012
- Dongbin Lee, C. Nataraj, and Timothy C. Burg, "Robust Control of a Surface Vehicle with Disturbances," 2011 ASME Dynamic Systems and Control Conference (DSCC-6201), Oct.31 ~ Nov. 2, Arlington, Washington D. C., 2011 (presenter)
- Dongbin Lee, C. Nataraj, and Timothy C. Burg, "Adaptive Tracking Control of an Underactuated Aerial Vehicle," Proc. of American Control Conference (ACC-1474) 2011, July, Jun. 29 – Jul. 1, San Francisco, CA, 2011 (presenter)

Briefly list the most recent professional development activities

- FANUC Robotics Vision System Training Course has been completed to develop course and labs or advise students especially, in manufacturing engineering at Oregon TECH (OIT)

Name: Steven G. Lemery Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title

Adjunct Professor

Year of OIT Employment: 2012 **Years of Service: 4**

Academic Degrees

1983 - 1987 Oregon Institute of Technology Klamath Falls, Oregon
Bachelors of Science - Manufacturing Engineering of Technology
2004 – 2007 Oregon Institute of Technology Everett, Washington Master of Science in Manufacturing Engineering of Technology

Professional Licenses and Certificates

2004 Composite Engineering Technology Certificate Oregon Institute of Technology

2013 Systems Engineering Certificate California Institute of Technology

Academic Experience

Oregon Institute of Technology Adjunct Professor for under graduate and graduate courses in Manufacturing Engineering of Technology

Professional Experience, Consulting, Patents

29 years as an engineer at the Boeing Company in Washington State
Patents:
March 2011 – Composite Material Structure with Interlayer Electrical Conductance – 7,897,249
May 2011 – Toughened Resin Fiber Laminates with Titanium Particles – 7,935,214
November 2011 - Toughened Resin Fiber Laminates with Titanium Particles – 8,057,888

Principal Publications

Internal Boeing Reports:

SR 10684 Characterization of Carbon/epoxy interwoven wire (phos-bronze fabric prepreg cured

SR 11156 Silicone RTV 102 & RTV 106 on Tedlar (TWH 20 BS 3)

SR11337 Thermal Degradation Testing of Composite Honeycomb Core Materials used in Thrust Reverser Inner Walls

SR 11268 Silicone RTV 102 with P5200 adhesion promoter on Tedlar (TWH 20 BS 3)

SR 11097 Fractue Analysis of CRES Foil Insulation Blanket 315W1814-59

SR 12622 Nonadvocate Review of Microcracks in CFRP Wing Ribs Riveted to Aluminum Shear Ties

SR 11642 737 Next Generation (NG) Thrust Reverser Inner Wall Heat damage, Mechanical Tests

SR 12674 Riveting in CFRP structures to minimize micro-cracking

SR 12623 Aluminum Shear Ties Riveted to CFRP Wing Ribs: Riveting Development

Scientific and Professional Society Memberships

Past member of SME and SAMPE

Honors and Awards

Boeing Certificate of Team Excellence from Boeing Missile Systems Division
For contribution of the Launch Support System FCA/PCA Configuration Audit
For Minute Man / Peace Keeper Missile Launch Systems

Boeing Certificate of Outstanding Performance on 737 Next Generation Payloads
Interior Design and Build/Installation Excellence

Boeing Outstanding contribution to the Digital Assembly Sequencing of the 737 Next
Generation Fuselage, Systems and Wing

Institutional and Professional Service

Adjunct Professor for OIT 2012 - 2016

Professional Development Activities

2013 Systems Engineering Certificate California Institute of Technology
Attend on-line seminars on additive manufacturing, robotic assembly, advanced composites

Name: Anthony F. Marostica Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Adjunct Instructor

Year of OIT Employment: 2010 **Years of Service:** 6

Academic Degrees:

B.S., Manufacturing Engineering Technology, Oregon Institute of Technology (1998)
Associate of Engineering Technology, Oregon Institute of Technology (1991)

Academic Experience:

2010 – Present	Adjunct Instructor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Klamath Falls, OR.
1998 – 2009	Achieving Independence Instructor, Klamath-Lake County Youth Ranch, Bonanza, OR
1989 – 1997	Vocational Instructor, Klamath-Lake County Youth Ranch, Bonanza, OR

Professional Experience:

1977 – 1987	Lumber Production, Weyerhaeuser Company, Klamath Falls, OR
1975 – 1977	Manager/Living Skills Trainer, Klamath Work Activity Center, Klamath Falls, OR

Community Service:

Klamath Falls Jaycee's, Klamath Falls, OR

- Chapter Vice President
- Chairman of the Board

Name: Joshua (Josh) T Millard　　　　　　　　　　Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology (MMET)

Academic Rank: Visiting Professor

Year of OIT Employment: 2015　　　　**Years of OIT Service:** < 1

Academic Degrees:

M.S. Mechanical Engineering, South Dakota School of Mines and Technology (2014)
B.S. Mechanical Engineering, South Dakota School of Mines and Technology (2010)
B.S. Electrical Engineering, South Dakota School of Mines and Technology (2005)

Academic Experience:

2015 – Present　Visiting Professor of Mechanical Engineering, Oregon Institute of Technology
2005 – 2014　Graduate Teaching Assistant, South Dakota School of Mines and Technology

Industry Experience:

Research Experience:

2005 – 2014　Graduate Research Assistant, South Dakota School of Mines and Technology

Principal Publications:

Conference Presentations:

Institutional Service:

Professional Service:

- Served as a reviewer of higher-education textbooks.

Professional Affiliations:

- American Society of Mechanical Engineers
- American Association for the Advancement of Science
- American Society for Engineering Education

Name: Bradford A. Moravec Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title Adjunct Professor

Year of OIT Employment: 2013 **Years of Service: 3**

Academic Degrees BSME, MSAA, DBA

Professional Licenses and Certificates

none

Academic Experience:
3 years undergraduate mathematics at Argosy University, 3 years undergraduate and graduate engineering at OIT

Professional Experience, Consulting, Patents

36 Years in Propulsion Engineering at Boeing,

Principal Publications (last five years only)

None

Scientific and Professional Society Memberships (current only)

AIAA, ASME, FSPE

Honors and Awards

- 2013 BCA Engineering Team of the Year nomination
- 2003 Achievement Award - Special FAA Regulation SFAR 88 Fuel Tank Ignition Prevention
- 2001 Recognition Award - Aviation Rulemaking Advisory Committee
- 1999 NASA Achievement Award - High Speed Research Program
- 1998 SAE Arch T. Colwell Merit Award (Paper of outstanding technical merit)
- 1997 SAE Manly Memorial Award (Best paper in 1996 related to aerospace engines)
- 1997 SAE Wright Brothers Medal (Best paper in 1996 related to furthering flight technology)
- 1996 Special Performance Award 767 AWACS Program
- 1996 Achievement Award 777/Trent 800 certification & delivery
- 1996 Achievement Award 777/GE90 Fan Blade Clearance Critical Issues Team.
- 1994 Achievement Award 747 Flying Testbed Outstanding Performance
- 1992 Renton Division Employee of the Month (757 Engine Surge Investigation and Resolution)
- 1990 Propulsion Engineering Peer Award (737 Rain & Hail Ingestion Study)

- 1989 FAA Certificate of Designation (DER in Powerplant Installations)

Institutional and Professional Service (last five years only)
National Society of Black Engineers (NSBE) mentor

Professional Development Activities (last five years only)

2013 Doctorate in Business Administration

Name: Brian A. Moravec Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Professor

Year of OIT Employment: 1989 **Years of Service:** 26

Academic Degrees

M.S., Aeronautics and Astronautics, University of Washington (1987)
B.S., Mechanical Engineering, University of Washington (1980)

Professional Licenses and Certificates

EIT, 1980

Academic Experience

2015-Present Professor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Klamath Falls, OR.

2014-2015 Professor and Director OIT-Seattle, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Seattle, WA.

2007-2014 Professor and Department Chair, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Klamath Falls, OR.

1995-2007 Associate Professor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Klamath Falls, OR.

1989-95 Assistant Professor, Mechanical Engineering Technology Department, Oregon Institute of Technology, Klamath Falls, OR.

Professional Experience, Consulting, Patents

1987-89 Specialist Engineer, Boeing, Seattle, WA
1982-87 Senior Engineer, Boeing, Seattle, WA
1980-82 Engineer, Boeing, Seattle, WA
1979 Engineering Intern, Puget Sound Naval Shipyard, Bremerton, WA

Principal Publications (last five years only)

Scientific and Professional Society Memberships (current only)

Member Society of Automotive Engineers (Oregon Tech Faculty Advisor to both the Formula SAE team and the Baja SAE team).

Honors and Awards

OIT Student Award Recipient
OIT Faculty Achievement Award, Engineering Faculty Member of the year
OIT Faculty Alumni Engagement Award

Institutional and Professional Service (last five years only)
MMET Department Chair 2010-2014.
PLTW Affiliate Director for the State of Oregon, 2015 – present.
Advising approximately 35 MET/ME/MFG students.
Faculty Advisor, SAE club.
Faculty Advisor, Baja SAE club.
MET/ME/Mfg advisor for MECOP.
Member Oregon Tech Facilities Planning Committee
BSME Program Director 2015-Present.
Oregon Tech University Representative to the MECOP/CECOP Engineering Internship Programs (1/4 release time at the Associate Dean Level).

Professional Development Activities (last five years only)

Attended the 3-day Project Lead the Way Planning Session 2009, 2010, 2011, 2012, and 2013.
Project Lead the Way Affiliate Professor for Principles of Engineering, taught core curriculum at summer training for the last 5 years.
Attend SAE Baja and/or Formula events 2010, 2011, 2012, 2013, 2014, 2015.
Working on the Advanced Aerospace Manufacturing Education Project for the last 5 years.
Working on project for the Army Research Lab to develop the MFG Masters Program for distance delivery
CO-PI for NITC Combined Traction and Energy Recovery Motor for EV's Project, modeling hydraulic/ICE/Electrical vehicle propulsion systems.
Workshop, Advanced Hydraulic Theory and Modeling using Easy 5 2015

Name Dr. Nathan Mead December 15, 2015

Department Manufacturing and Mechanical Engineering and Technology

Academic Rank Professor

Year of OIT Employment 1998

Academic Degrees

Ph.D, Mechanical Engineering, University of Utah (1998)
M.S., Mechanical Engineering, Oregon State University (1991)
B.S., Mechanical Engineering, Oregon State University (1989)

Professional Licenses and Certificates

Engineer-In-Training (1989)

Academic Experience

20012-	Professor, Department of Manufacturing and Mechanical Engineering and Technology, Oregon Institute of Technology - Seattle (full time)
2006-12	Associate Professor, Department of Manufacturing and Mechanical Engineering and Technology, Oregon Institute of Technology – Seattle (full time)
2004-06	Associate Professor, Department of Manufacturing and Mechanical Engineering and Technology, Oregon Institute of Technology (full time)
1998-04	Assistant Professor, Departments of Manufacturing and Mechanical Engineering Technology, Oregon Institute of Technology (full time)
2015-	Adjunct Professor, Science & Technology Program (Mechanical Engineering), University of Washington – Bothell (part time)
1997-98	Instructor, Mechanical Engineering, University of Utah (part time)
1989-91	Teaching Assistant, Mechanical Engineering, Oregon State University (part time)

Professional Experience

2011 -	Chief Engineer, American Tractor LLC, Burien, WA
1997-	Manufacturing and Mechanical Consulting Engineer
1994-97	Mechanical Engineer, Sarcos Research Corp, Salt Lake City, UT
1992-94	Manufacturing Engineer, Center for Engineering Design, Salt Lake City, UT
1986-87	Design Engineer-Draftsman, Eugene Metal Finishers, Eugene, OR
1986-	Vice President, Martin Rapids Farm, Vida, OR
1974-86	President, Mead Farms Inc., Vida, OR

Other Academic Duties

Co-program Director, OIT-Seattle Program, Seattle WA, (2015- Present)
Program Director, OIT-Boeing Program, Seattle WA, (2005-2008)
Assistant Program Director, OIT-Boeing Program, Seattle WA, (2005)
Graduate Project Advisor, Klamath Falls & OIT-Boeing, (2005-Present)
Graduate Advisor, OIT-Boeing (2005-Present)
MFG Graduate Program Representative, Graduate Council, (2004-2007)
Graduate Advisor, Klamath Falls (2004-2006)
Graduate Program Director, Manufacturing Engineering Technology (2004-2007)
Web Content Manager, Graduate program in MFG (2005-2007)
Web Content Manager, Boeing-OIT Outreach Program (2005-2006)
Curriculum Coordinator, Department of Manufacturing Engineering Technology (1999-2004)
Scheduling Coordinator, Department of Manufacturing Engineering Technology (1999-2004)
Member, Manufacturing Engineering Technology Industrial Advisory Council (1998-Present)
Laboratory Coordinator, Department of Manufacturing Engineering Technology (1999-2006)
Member, Manufacturing Engineering Technology Faculty Search Committee (2005)
Student Advisor, Dual MET/MFG Majors and MFG Transfer Students (1999-2006)
Chair, Manufacturing Engineering Technology Faculty Search Committee (2004)
Member, Student Hearings Commission (2000–2004)
Member, Provost Search Committee (2003)
Webmaster, Department of Manufacturing Engineering Technology (2002-2005)
Faculty Advisor, Society of Manufacturing Engineers, Student Chapter SO36 (1998–2002)
Member, Manufacturing Engineering Technology Faculty Search Committee (2001)
Chair, Department of Manufacturing Engineering Technology (2001)
Member, Advisory Committee for Distributed Learning and Distance Education (2001)
Member, Bookstore Commission (2000–2001)
Chair, Manufacturing Engineering Technology Faculty Search Committee (1999)
Advising Coordinator, Manufacturing Engineering Technology Department (1998-1999)

Publications

P. B. Stickler, D. McCarville, M. Richey, N. Mead, D. Tiefel, M. Graves, S. Lee; *The OIT-Boeing Composite Certificate Program*; 2007 Conference Proceedings, American Society for Composites; Sept. 2007

Continuing Professional Education

2009 LabView training seminar, Lynnwood, WA
2007 LabView training seminar, Bellevue, WA
2004 FeatureCAM Training Center Seminar, SLC Utah
2002 WebCT Training seminar
2002 FeatureCAM Training Center seminar, SLC Utah
2001 ABET Engineering Technology Faculty Workshop
2000 Credit for Prior Learning (Portfolio method) seminar
2000 Ethics Across the Curriculum seminar
1999 ASEE Symposium on Technology, Klamath Falls, OR
1999 ASME Graduate Student Conference, Klamath Falls, OR

Name: Anne Marie Riechmann

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Adjunct Faculty

Year of OIT Employment: 2012 **Years of Service:** 4

Academic Degrees

BSME, Worcester Polytechnic Institute, 1986. Graduated with Distinction.
MS Biomedical Engineering, New Jersey Institute of Technology, 1990.

Academic Experience

2012-Present: Oregon Institute of Technology, Adjunct Instructor

1998-1999: Indiana University-Purdue University – Fort Wayne, Instructor

Professional Experience, Consulting, Patents

2008- 2009 Aptimise LLC., Fort Wayne, IN
Product Development Consultant, Full Time

1996-1998 DePuy Orthopaedics, Inc., Warsaw, IN
Product Development Engineer – Custom Implant Group, Full Time
Product Development Engineer – Knee Group, Full Time

1990-1991 University of Medicine and Dentistry of New Jersey Newark, NJ
Biomedical Technician, Full Time

1986-1988 Union Carbide Corporation, Ecorse, MI
Plant Engineer, Environmental Affairs Coordinator, Full Time

Patent No. #5,536,271 Patella Preparation System

Certifications or professional registrations:

Current membership in professional organizations:

Service activities

2011-Present: ASPIRE Mentor at Klamath Union High School.

2013-2015: ASPIRE Coordinator.

2011-2015: Klamath Union Booster Club President.

2010-2011: Klamath Union Booster Club Vice President

2010-2015: Klamath Union Theatre, Choir and Orchestra Parent

2010-2015: Girls Scouts of Oregon and Southwest Washington.

2001-2010: Girls Scouts of Indiana and Southwest Michigan.

Recent publications

Professional Development Activities (last five years only)

Learned MATLAB and Visual Basic for Applications.

Name: Randall R. Rochester Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Adjunct Professor Speech and Communication, Oregon Tech

Year of OIT Employment: 1999 **Years of Service:** 16

Academic Degrees:

M.B.A., City University, 1992

B.A.E., Pacific Lutheran University, 1978

Professional Licenses and Certificates:

Professional Certificate of Instruction, Everett Community College, 1998.

Academic Experience: 1999 to Present; Adjunct Professor of Communication and Speech courses SPE 111, SPE 321, and COM 347; OIT @ Boeing Program.

Professional Experience, Consulting:

1995 to Present	Corporate Trainer, The Boeing Company
1992 to 1994	World Class Competitiveness Instructor, The Boeing Company
1989 to 1992	Industrial Engineering Analyst, The Boeing Company

Principal Publications (last five years only)

Scientific and Professional Society Memberships (current only)

Honors and Awards

Institutional and Professional Service (last five years only)

Professional Development Activities (last five years only)

Name: Randy Shih Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank: Professor

Year of OIT Employment: 1984 **Years of Service:** 32

Academic Degrees:

M.S., Mechanical Engineering, University of Nebraska, Lincoln, Nebraska, 1984
B.E., Mechanical Engineering, Chung-Yuan University, Chung-Li, Taiwan, 1979

Academic Experience:

1999-Present	Professor of Manufacturing and Mechanical Engineering and Technology, Oregon Institute of Technology
1990-1999	Associate Professor of Mechanical Engineering Technology, Oregon Institute of Technology
1984-1990	Assistant Professor of Mechanical Engineering Technology, Oregon Institute of Technology

Professional Experience, Consulting, Patents:

Full-time industrial experience:

1981-1982	Design Engineer, Goshen Industrial Co., Ltd.
1979-1981	Maintenance Engineer, Army Artillery Maintenance Group

Part-time industrial experience:

2014	Development Engineer, Cell Tech International Inc.
2004 (summer)	Development Engineer, Shung Ye Co., Ltd.
2003 (summer)	Product Design Engineer, Sun Metal Co., Ltd.
2001 (summer)	Product Design Engineer, Sun Metal Co., Ltd.
1999 (summer)	Product Design Engineer, Sun Metal Co., Ltd.
1997 (summer)	Development Engineer, Shung Ye Co., Ltd.
1996 (summer)	Development Engineer, Shung Ye Co., Ltd.
1995 (summer)	Product Design Engineer, Sun Metal Co., Ltd.
1992 (summer)	Development Engineer, Shung Ye Co., Ltd.
1991 (summer)	Product Design Engineer, Sun Metal Co., Ltd.
1987 (summer)	Product Design Engineer, Sun Metal Co., Ltd.
1986 (summer)	Development Engineer, Shung Ye Co., Ltd.
1985 (summer)	Product Design Engineer, Sun Metal Co., Ltd.
1984-1984	Draftsman, (Part-time), Lincoln Manufacturing Co., Ltd.
1979-1979	Instructor (Part-time), Hsian Hao Primary School

Consulting:

2014	Cell Tech. – June 2014 Computer Aided Design/Drafting consulting work

2005	CAD System Consultant, Thermo Products Co.
1999	Computer Aided Drafting Consultant, Mask Construction Co.
1997	CAD System Consultant, Chapman-Huffman Co.
1995	CAD System Consultant, Thermo Products Co.
1994	CAD System Consultant, Columbia Plywood Co
1993-2001	CAD System Consultant, Klamath Machinery Co.
1993	CAD System Consultant, Seattle Drafting Co.
1993	CAD System Consultant, Winema & Fremont National Forest Service
1992	CAD System Consultant, Vincent Botanical service
1992	CAD System Consultant, Carriage Works
1987	CAD System Consultant, Diamond Cabinets Co.
1987	CAD System Consultant, Ben-Fab Co.

Principal Publications (last five years only)**:**

2015	Shih, R. H., "A Hands-on Project approach to Teach Solid Modeling." Paper presented at the 2015 ASEE Conference, Seattle, WA
2016	Schilling, P. & Shih, R. H. "Parametric Modeling with SolidWorks", SDC publications
2016	Shih, R. H. "Principles and Practices", SDC publications
2015	Shih, R. H. "Introduction to finite Element Analysis using SolidWorks", SDC publications
2015	Shih, R. H. "Parametric Modeling with Inventor", SDC publications
2015	Shih, R. H. "AutoCAD Tutorials – 3D Modeling", SDC publications
2015	Shih, R. H. "AutoCAD Tutorials – 2D fundamentals", SDC publications
2014	Shih, R. H. "Parametric Modeling with Creo", SDC publications
2014	Shih, R. H. "Introduction to finite Element Analysis using Creo", SDC publications

Scientific and Professional Society Memberships (current only)**:**

Member, American Society for Engineering Education

Honors and Awards:

1991 OIT Outstanding Teacher Award

2002 EDS Engineering Excellence Award (Courseware Development)

Institutional and Professional Service (last five years only)**:**

Committee Assignments and Positions at Oregon Institute of Technology:

- MMET Promotion and Tenure Review Committees
- MMET Post Tenure Review Committees
- Americans with Disability Act Committee
- MET Faculty search Committees
- International Exchange Program Committee
- Advising Coordinator
- Scheduling Coordinator

Name: Sean E Sloan Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Assistant Professor

Year of OIT Employment: 2011 **Years of Service:** 6

Academic Degrees

Teaching Certification, Benedictine University (2005)
M.S., Mechanical Engineering, University of Illinois (1994)
B.S., Mechanical Engineering, University of Illinois (1989)

Professional Licenses and Certificates

EIT, 1988

Academic Experience

2011-Present, Assistant Professor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology (OIT), Klamath Falls, OR.
2012-2014, ME Curriculum Coordinator, OIT, Klamath Falls, OR
2005-2010, Secondary Education Teacher, Illinois

Professional Experience,

2001-02	Project Engineer, Anvil, Bellingham, WA
2000-01	Senior Sales Engineer, adapco, Seattle, WA
1994-99	Thermal Hydraulic Lead Research Engineer, Naval Reactors, DC
1989-90	Project Engineer, IBM, East Fishkill, NY

Principal Publications (last five years only)

2016 Effectiveness of Solar Powered Ventilators, Sloan

Scientific and Professional Society Memberships (current only)

ASME (Faculty Advisor).

Honors and Awards

2013 Panel on Computational Fluid Dynamics, CD-adapco annual conference, Orlando, FL

Institutional and Professional Service (last five years only)

ME curriculum coordinator 2012-2014
Faculty Senator 2014-2016
Created curricula: Computational Fluid Dynamics, Nuclear Power, Laser Materials Processing
Created the labs for Fluids I and most of Fluids II
Advising approximately 44 MET/ME/MFG students.
Faculty Advisor, ASME club.
Member Faculty Compensation Committee
Member Oregon Tech Facilities Planning Committee
Member Student Awards Committee

Founder Oregon Laser Institute 2016

Professional Development Activities (last five years only)
Attended the week long Project Lead the Way training 2012.
Attended 3-day seminars on CFD 2012, 2014.
Attended ASME competitions 2012, 2013, 2014, 2015.
Completed $20,000 grant from Oregon Best on Solar Powered Ventilators.
Obtained $200,000 grant for a high power laser for Oregon Laser Institute
Obtained $50,000 Laser Doppler Velocimeter for $10,000 of OIT money
Various Webinars on CFD and heat transfer
Advanced state of the art with thermal syphon technology for heat pumps
Member NWCSM manufacturers consortium

Name (William) Joe Stuart Winter 2016

Department Manufacturing and Mechanical Engineering and Technology

Academic Rank Associate Professor – Granted Tenure 2010

Year of OIT Employment 2004 **Years of Service** 10

Academic Degrees

M.Sc., Physics, University of Southampton, UK (1972)
B.Sc., Metallurgical/Mechanical Engineering, University of Nevada, Reno (1969)
A.A.S., Metallurgical Technology, Erie Technical Institute, Buffalo, NY (1966)

Professional Licenses and Certificates

Professional Engineer. PE Cert # 7811237, Toronto, Ontario, Canada

Academic Experience

2010-Present	Associate Professor of Manufacturing and Mechanical Engineering and Technology, Oregon Institute of Technology
2005-2010	Assistant Professor of Manufacturing and Mechanical Engineering and Technology, Oregon Institute of Technology
2004-2005	Visiting Professor of Manufacturing and Mechanical Engineering and Technology, Oregon Institute of Technology

Professional Experience, Consulting, Patents

Full-time industrial experience

2002-2004	National Accounts Mgr., Wagner Electronics
1998-2002	Pres/Owner, Best Tech USA
1985-1998	VP and Gen Mgr., Alumaweld Boats Inc. & Rogue Trailers Inc.
1984-1985	Manufacturing Rep/ Field Engineer, MDA Associates
1981-1984	Quality Engineer, International Memories Inc.
1980-1981	Design Engineer, Balteau Standard
1977-1980	Field Engineer, Wisar Construction
1975-1977	Gen Mgr., Milthorn Toleman Ltd.
1974-1975	Chief Scientist, Puerto Rico Nuclear Center
1972-1974	Engineering Consultant, EPA Subcontract
1969-1970	Metallurgical Engineer, Republic Steel

Principal Publications

2014 Stuart W. J. and Sheffield N.R. ‘ Fast Formative Feedback using Muddiest Points and Just In Time tools in Engineering Material Courses’

2010 Stuart W.J. (OIT) and Bedard R. (EPRI) ‘Ocean Renewable Energy Course’

2010 Sept. 2010 @ Energy Ocean Pacific & Oregon Wave Energy Trust

2009 Stuart, W.J. “Corrosion Considerations When Designing with Exotic Metals and Advanced Composites, Corrosion Conference of Exotic metals in Park City, UT

2009 Stuart, W.J. “Wave Energy 101” Presented @ Oregon Wave Energy Conf.

2008 Stuart, W.J. “Three pronged Approach to Sustainability at OIT.” Presented to faculty and staff at OIT 2007 Fall Convocation and updated for Tech Tuesday.

Institutional and Professional Service

Committee Assignments and Positions and other academic duties at Oregon Institute of Technology:

- Program Director for MFGT
- MFGT Assessment Coordinator
- Facilities Planning Committee
- MMET Search Committee Chair for Seattle Program Director
- MMET Search Committee Chair (multiple committees)
- MMET Search Committee member (multiple committees)
- MMET Department Industrial Advisory Board
- Curriculum Planning Committee
- OIT Admissions Committee
- OIT Strategic Planning Initiative Committee, Team Leader and co-author of SPI 2007
- OIT Sustainability Committee, Chair
- Member Steering Committee: Faculty Examination of Academic Administrative Structure
- OREC Advisory Panel

Scientific and Professional Society Memberships (current)

Senior Member- Lifetime-Society of Manufacturing Engineers
Member, American Society of Engineering Educators
Active in Southern Oregon High Performance Enterprise Consortium

Professional Development Activities (last five years)

2009 Corrosion Conference

2008-2009 Oregon Wave Energy Trust Symposium III and IV.

2007 Solar Conference

2006 ASEE Annual Conference
2006 Sustainability Workshop, Carnegie Mellon University; Developed Sustainability Modules for OIT classes

Name: Matthew D. Walter Spring 2016

Department: Manufacturing and Mechanical Engineering and Technology

Academic Rank and Title: Adjunct Instructor

Year of OIT Employment: 2011 **Years of Service:** 5

Academic Degrees:

Limited Teaching Credential, University of California Berkeley Extension Program, Berkeley, CA (1982)

A.A., Welding Technology, College of San Mateo, San Mateo, CA (1977)

Professional Licenses and Certificates:

Certificate, Krautkramer NDT, Ultrasonic testing level II, 1994

Certificate, Supervision, Los Positas JC, Livermore, CA, 1994

License #96120861, Welding & Inspector Certification, American Welding Society, 1980

Academic Experience:

2011 – Present	Adjunct Instructor, Manufacturing and Mechanical Engineering and Technology Department, Oregon Institute of Technology, Klamath Falls, OR.
2011 – Present	Welding Instructor, Klamath Community College, Klamath Falls, OR.
1988 – 2002	Welding Instructor, Los Positas Junior College, Livermore Ca.
1980 – 1983	Welding Instructor, Chabot College, Hayward Ca.

Professional Experience:

2003 – Present	W3 Metal Fabrication/Welding, W3 Ranch, Chiloquin, Oregon
1977 – 2003	Metal Fabricator/Welding Inspector, Lawrence Livermore National Laboratory, Livermore, CA

Appendix C – Equipment

The major equipment in the Klamath Falls laboratories are shown below; following this list are pictures of some of the equipment.

Lab Name: Composites Lab

Quantity	Item Description
1	Vacuum pump and piped in system
4	Large work benches for student work areas
1	Fillament Winder
1	Jet Rotary Sander
1	Lincoln Vertical Metal Band Saw
1	Powermatic Sander
1	Manual Mill (Boice Crane)
4	Air Sanders
4	Rotary Cutting Tools
1	Grinder
4	Vises
2	Vaccum Lines (6 Hoses a Piece)
3	Heat Guns
40	Yards of Vaccum Bagging
15	Yards of Peel Ply
25	Yards of Breather
3	Yards of Hybrid
6	Yards of Kevlar
20	Yards of Carbon Fiber 3k 2x2 Twill
5	Yards of Veil
1	Yard Chopped Cloth
10	Yard Uni Directional
2	Rolls of Uni Directional Pre Preg (1 Carbon 1 Fiberglass)
15	Yards of 25 oz Fiberglass
3	Gallons Acetone
2	Gallons 635 Epoxy
1	Gallon 3:1 Hardener
25	Squeegees
50	Paint Brushes
50	Cups

Lab Name: Machine Shop

Quantity	Item Description
16	manual lathes
3	vertical band saws
3	horizontal band saws
6	bench grinders
1	surface grinder
1	arbor press
3	manual vertical mills with digital readout (bridgeport type)
4	manual vertical mills without digital readout (bridgeport type)
1	6'x6' granite table / metrology equipment
1	drill press
	Additional tooling/machines available for advanced student use
3	tool grinders: large drill bit sharpener and 2 carbide tool sharpeners
1	band saw blade welder
4	horozontal manual milling machines
1	drill sharpener derex
1	end mill sharpener derex
1	very large drill press

Lab Name: CNC Lab

Quantity	Item Description
1	Dyna Myte 4400 vertical cnc milling center
1	Cincinati V400 large vertical cnc milling center with pallet changer
1	Haas GT20 CNC lathe
1	Mirac Small CNC Lathe
1	Tong Small CNC Lathe
2	Davinci bechtop cnc machines
1	Haas TM1P vertical CNC milling center
1	Intelitek expertmill VML-0600 small vertical milling CNC center
12	high end computers for CAD/CAM work
2	Haas CNC trainer units

<u>Other Klamath Falls Equipment:</u>

Hampden Refrigeration System Trainer (2)
Pneumatic Instruction Bench by Hydraulic and Air Equipment Co. (2)
Hydraulic Systems Test Benches
Hydraulic Systems Test Benches base
Computerized Fluid Flow Tester

Tinius Olsen Testing Machine
Overview of Materials Lab
Tooling Bench and Cabinet for Specimens
Work Desk and Microscope
Vacu-Form ProtoVac 200
Buehler Metallurgical Apparatus
Hardness Testers

General Student Work Area / Table
Charpy Impact Tester (mfg. by Tinius Ols)
Heat Treat General Area
Lindberg Blue Oven
Heat Treat Materials/Tooling Storage
Grinders & Surfacing Machines
Polishers
Surfmet
Satec Creep Tester
Overview of Sr. Projects Lab / Technician
DeWalt Chopsaw
Clausing Gearhead Lathe Mod#6913
Bridgeport Milling machine
Pedestal Grinder
Miller Dynasty 200 TIG Welder
GW Manual Lathe
TubeShark Hydraulic Tubing bender
Torchmate and Htherm CNC Plasma Cutter
Hypertherm Powermax 800
Miller XMT 304 (6 Total)
Miller Dynasty 350 (2 Total)
Ellis bandsaw (2 Total)
Power Shear
Scotchman Cut-Off Saw
Miller 350P (3 Total)
Miller 350P
Welding Work Spaces
2 Wilton pedestal grinders and belt sander
DryRod Oven & Thelco Heat treatment Cabinet
Peerless Power Hacksaw
Manley Hydraulic Press
Northhill Square Shear
Gas Cutting and Welding Area
Millermatic 200 Wire Feed
Oxy-Acetylene Cutting Rig
Individual Work Area (20)
Victor Torch Cutting Set
DI-Acro Shear
Voest Hi-Capacity Shear 1/8" Max
Jet Hoist 2-Ton Capacity
Calipers (6)
Measuring Instruments / Storage
Depth Micrometers (4)
Optical Comparators
Vernier Height Gages & Granite Block
Gage Blocks
Gage Blocks (small, 6 total)
Posters / Use of GD&T Instruments
Gage Pins (medium)
Starrett Caliper Users Guide
Roughness Tester
Bore Gages
Radius Gages
Parts to Measure
Hurricane Laser, large & Brightstar Laser, small
Medium Shear
Fanuc Large Robotic Arm + Control
Fanuc Small CERT cart Robotic Arm/Control
Autonomous Small Robots
Kuka 6 axis Robotic Arm
Stepper Motor Learning System
PLC controlled cylindrical robot
EPS Training Bench
EPS / Motor Controls Training
Oscilliscopes and Electrical Training Equipment
EPS Learning Bench
Hampden Electronics Trainer
Hampden Dynamometer
AC / DC Motor Control Trainer
Special Projects Robotic Stations
Certified Education Robot Training Banner
Senior Design Center (10)
CAD/CAM/CAE Stations W/Dell Computers
Rapid Prototyping Dimension 720 FDM
PLC Training Board
Electronics / Controls tools, meters, instruments, function generators, power supplies, solder iron, breadboards, amps
Multimeters
Dead Weight Presssure Tester
Flow Channel
AVCO Shock Machine
Cabinet w/Fittings
Hydraulic Test bench

Wind Tunnel
Omega Digital Anemometer
Flow Rate Test bench
Flow Rate Test bench

Klamath Falls Laboratory Equipment

Figure 1: Hampden Refrigeration System Trainer

Figure 2: Hampden Refrigeration System Trainer

Figure 1: Pneumatic Instruction Bench by Hydraulic and Air Equipment Co. (2)

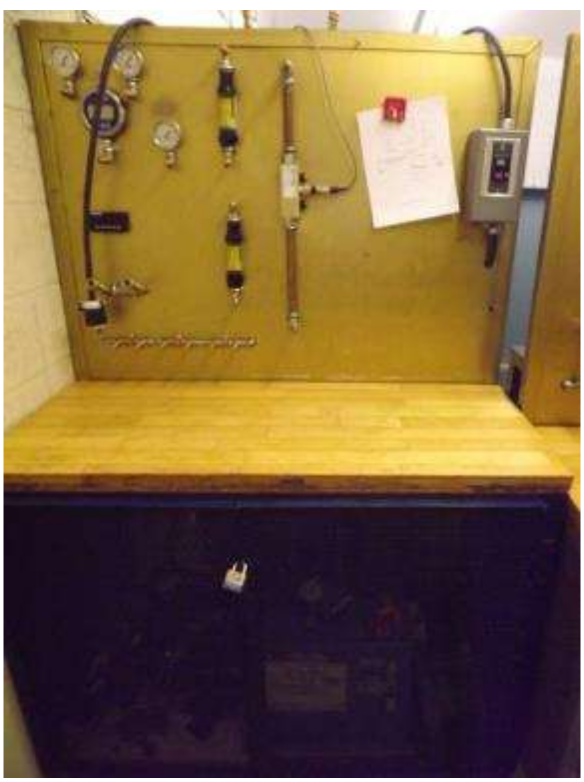

Figure 2: Hydraulic Systems Test Benches

Figure 3: Hydraulic Systems Test Benches base

Figure 4: Computerized Fluid Flow Tester

Figure 5: Tinius Olsen Testing Machine

Figure 6: Overview of Materials Lab

Figure 7: Tooling Bench and Cabinet for Specimens

Figure 8: Work Desk and Microscope

Figure 9: Vacu-Form ProtoVac 200

Figure 10: Buehler Metallurgical Apparatus

Figure 11: Hardness Testers

Figure 12: General Student Work Area / Table

Figure 13: Charpy Impact Tester (mfg. by Tinius Olsen)

Figure 14: Heat Treat General Area

Figure 15: Lindberg Blue Oven

Figure 16: Heat Treat Materials/Tooling Storage

Figure 17: Grinders & Surfacing Machines

Figure 18: Polishers

Figure 19: Surfmet

Figure 20: Satec Creep Tester

Figure 21: Overview of Sr. Projects Lab / Technician Office

Figure 22: DeWalt Chopsaw

Figure 23: Clausing Gearhead Lathe Mod#6913

Figure 24: Bridgeport Milling machine

Figure 25: Pedestal Grinder

Figure 26: Miller Dynasty 200 TIG Welder

Figure 27: GW Manual Lathe

Figure 28: TubeShark Hydraulic Tubing bender

Figure 29: Torchmate and Hypertherm CNC Plasma Cutter

Figure 30: Hypertherm Powermax 800

Figure 31: Miller XMT 304 (6 Total)

Figure 32: Miller Dynasty 350 (2 Total)

Figure 33: Ellis bandsaw (2 Total)

Figure 34: Power Shear

Figure 35: Scotchman Cut-Off Saw

Figure 36: Miller 350P (3 Total)

Figure 37: Miller 350P

Figure 38: Welding Work Space

Figure 39: 2 Wilton pedestal grinders and belt sander

Figure 40: DryRod Oven & Thelco Heat treatment Cabinet

Figure 41: Peerless Power Hacksaw

Figure 42: Manley Hydraulic Press

Figure 43: Northhill Square Shear

Figure 44: Gas Cutting and Welding Area

Figure 45: Millermatic 200 Wire Feed

Figure 46: Oxy-Acetylene Cutting Rig

Figure 47: Individual Work Area (20)

Figure 48: Victor Torch Cutting Set

Figure 49: DI-Acro Shear

Figure 50: Voest Hi-Capacity Shear 1/8" Max

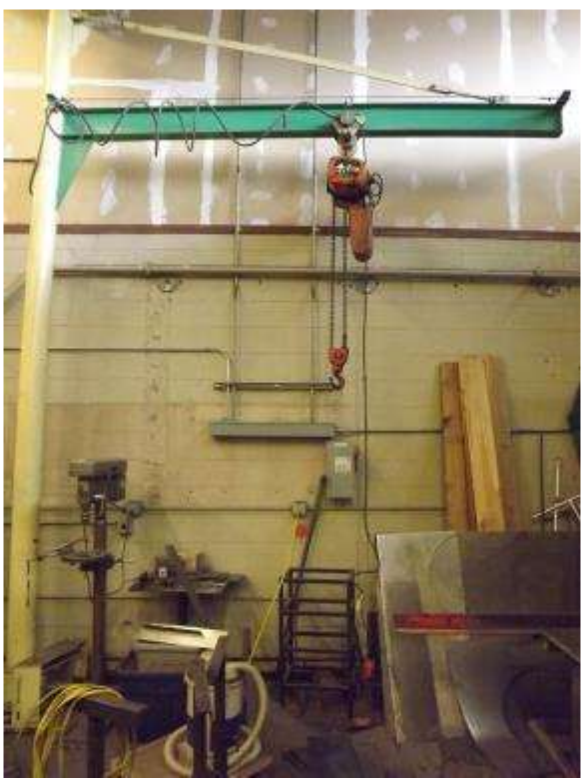

Figure 51: Jet Hoist 2-Ton Capacity

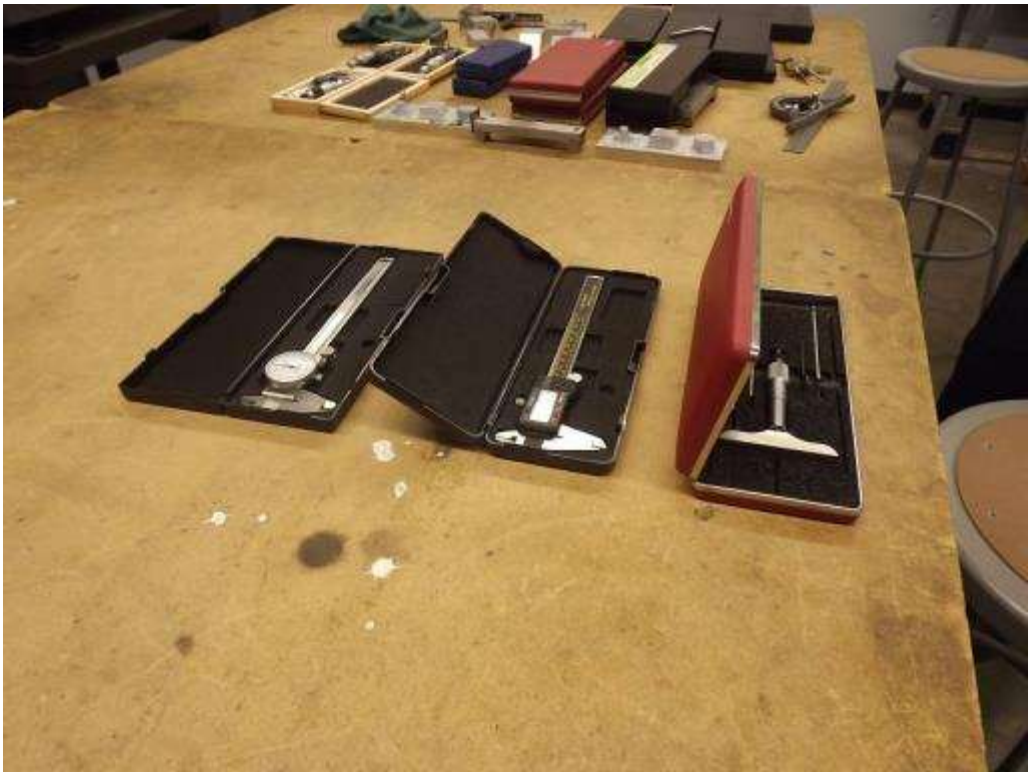

Figure 52: Calipers (6)

Figure 53: Measuring Instruments / Storage

Figure 54: Depth Micrometers (4)

Figure 55: Optical Comparators

Figure 56: Vernier Height Gages & Granite Block

Figure 57: Gage Blocks

Figure 58: Gage Blocks (small, 6 total)

Figure 59: Posters / Use of GD&T Instruments

Figure 60: Gage Pins (medium)

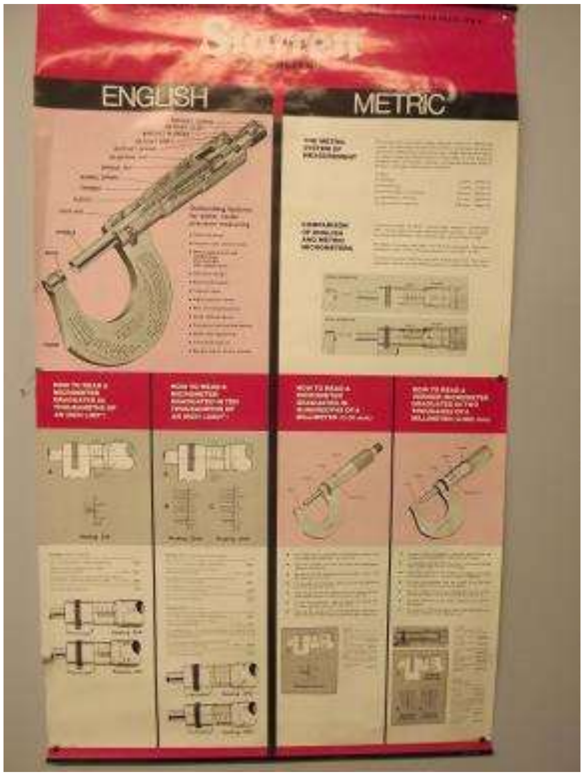

Figure 61: Starrett Caliper Users Guide

Figure 62: Roughness Tester

Figure 63: GD&T Lab / Workspace

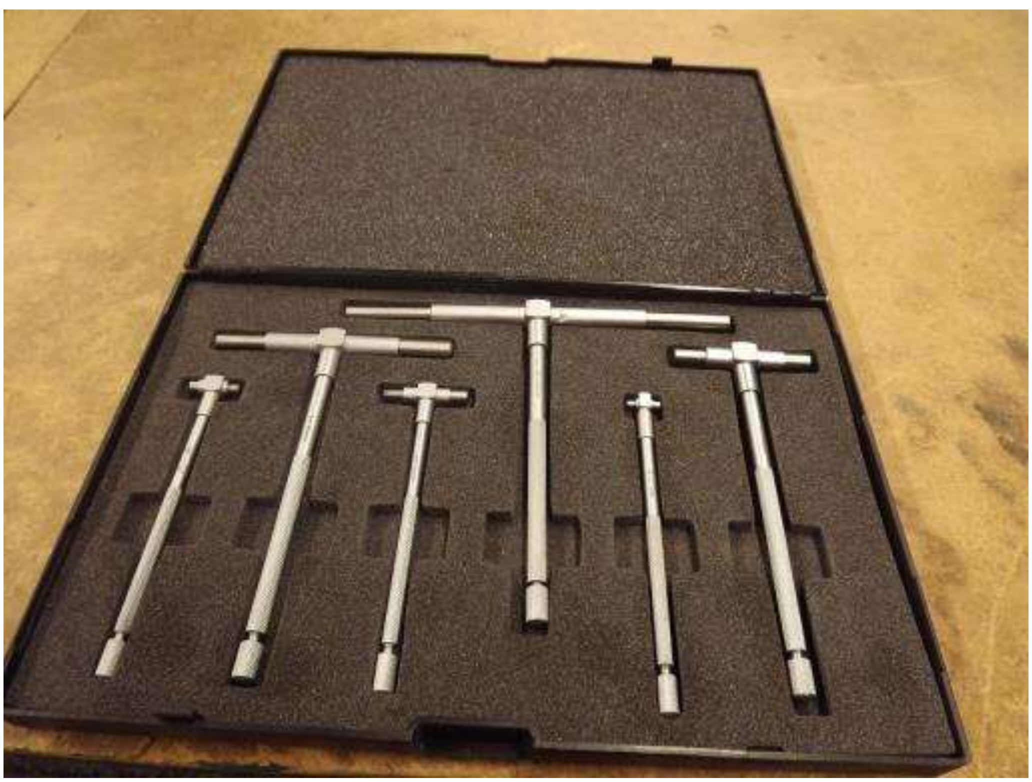

Figure 64: Bore Gages

Figure 65: Radius Gages

Figure 66: Parts to Measure

Figure 67: Hurricane Laser, large & Brightstar Laser, small

Figure 68: Medium Shear

Figure 69: Overview of Robotics and EPS Lab

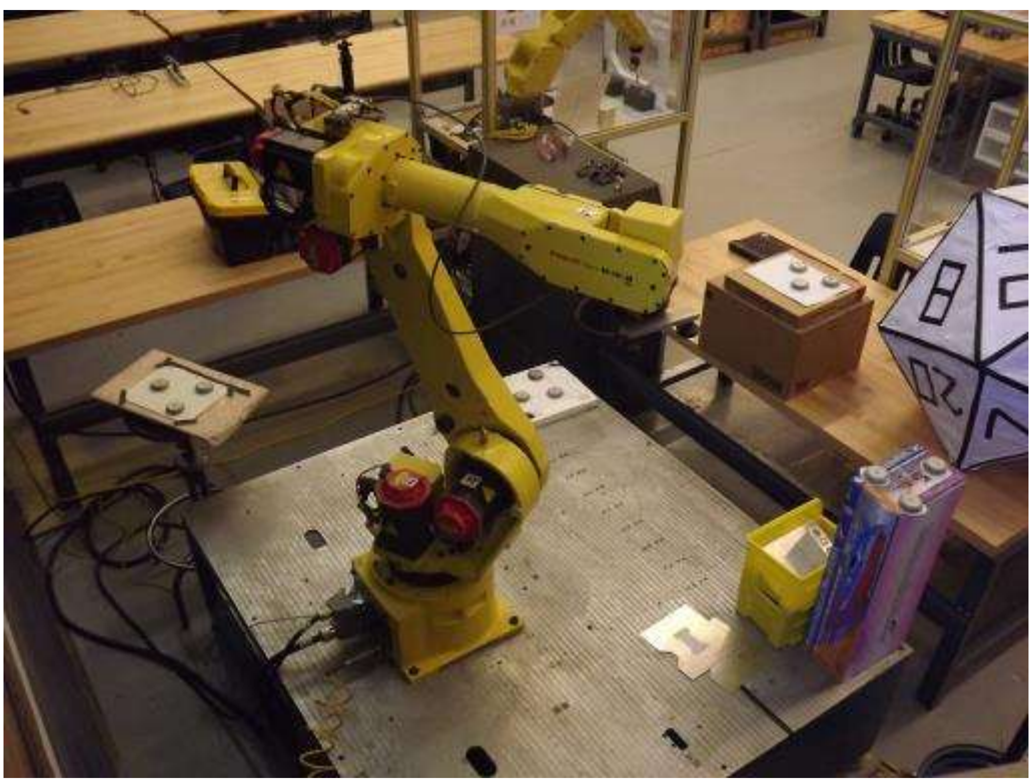

Figure 70: Fanuc Large Robotic Arm + Control

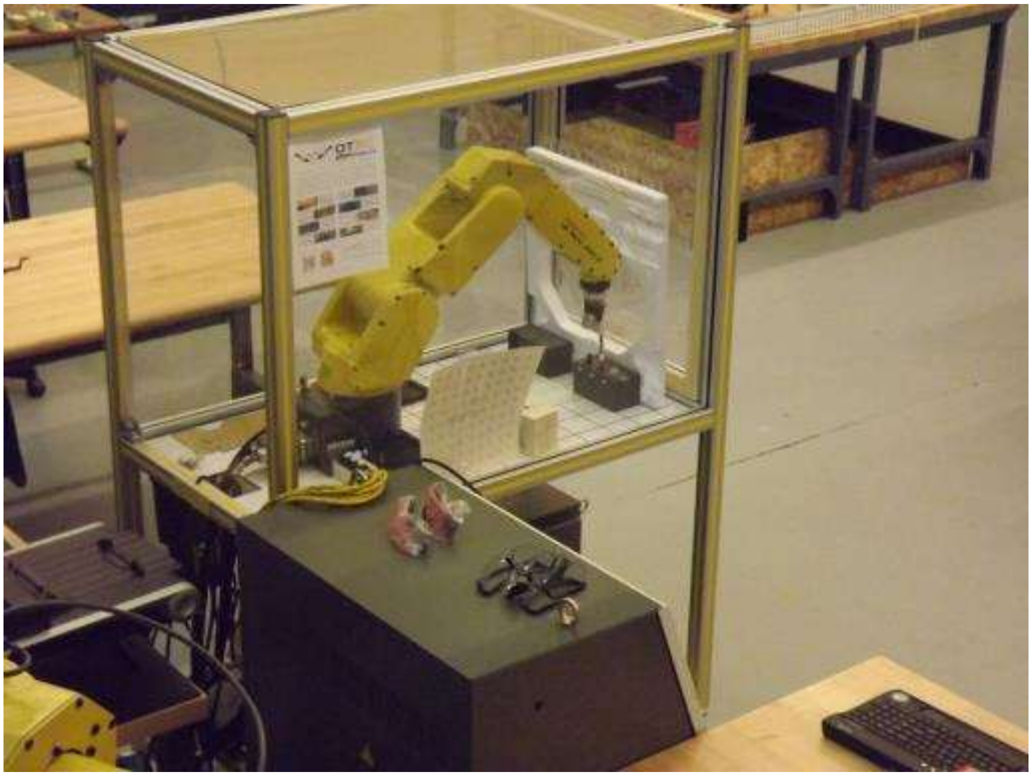

Figure 71: Fanuc Small CERT cart Robotic Arm/Control

Figure 72: Autonomous Small Robots

Figure 73: Kuka 6 axis Robotic Arm

Figure 74: Stepper Motor Learning System

Figure 75: PLC controlled cylindrical robot

Figure 76: EPS Training Bench

Figure 77: EPS / Motor Controls Training Bench

Figure 78: Oscilliscopes and Electrical Training Equipment

Figure 79: EPS Learning Bench

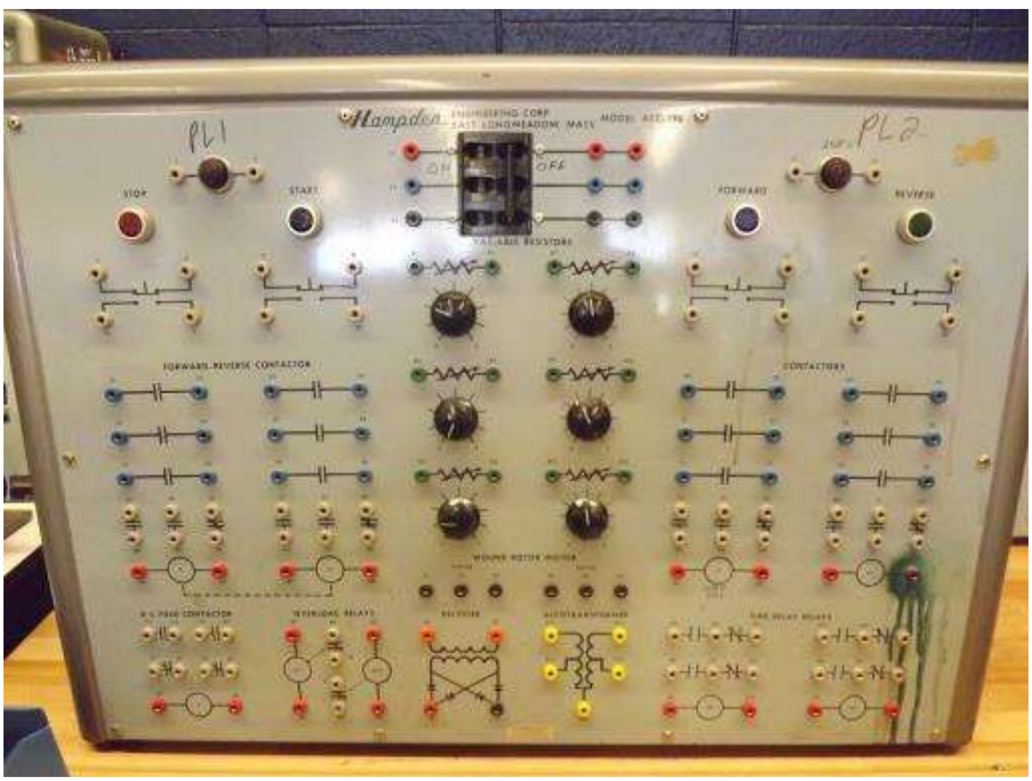

Figure 80: Hampden Electronics Trainer

Figure 81: Hampden Dynamometer

Figure 82: AC / DC Motor Control Trainer

Figure 83: Small Robot Workspaces w/computer

Figure 84: Special Projects Robotic Stations

Figure 85: Certified Education Robot Training Banner

Figure 86: Senior Design Center (10) CAD/CAM/CAE Stations W/Dell Computers

Figure 87: Rapid Prototyping Dimension 720 FDM

Figure 88: Instrumentation and Controls Lab

Figure 89: Instrumentation and Controls Lab

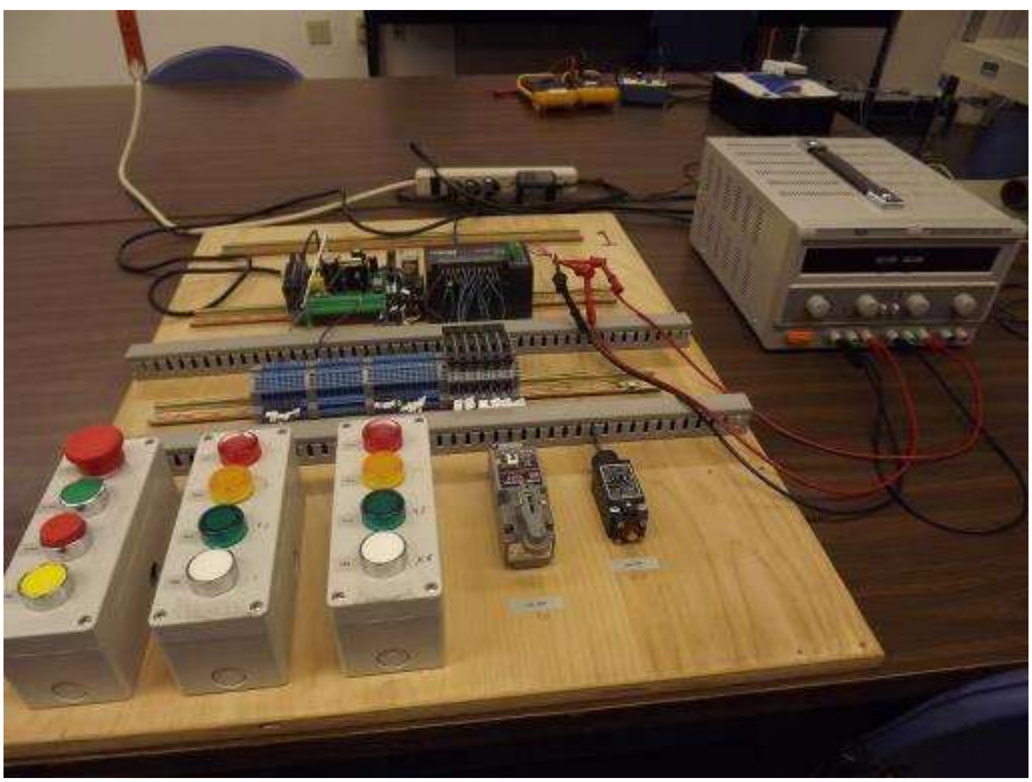

Figure 90: PLC Training Board

Figure 91: Electronics / Controls tools, meters, instruments, function generators, power supplies, solder iron, breadboards, amps

Figure 92: Multimeters

Figure 93: Dead Weight Presssure Tester

Figure 94: Flow Channel

Figure 95: AVCO Shock Machine

Figure 96: Cabinet w/Fittings

Figure 97: Hydraulic Test bench

Figure 98: Wind Tunnel

Figure 99: Omega Digital Anemometer

Figure 100: Flow Rate Test bench

Figure 101: Flow Rate Test bench

Figure 102: Clean Room

Figure 103: Clean Room

Figure 104: Computer Labs (CAD/CAE), Computation, CFD

Figure 106: Computer Labs (CAD/CAE), Computation, CFD

Figure 107: Manual Machining (mills, lathes, saws, grinders, drill presses

Figure 105: CAD/CAM Classroom

Figure 106: CNC Equipment

The major equipment in the Seattle laboratories are shown below; following this list are pictures of some of the equipment.

Seattle - Everett Equipment:

Refrigeration Cycle Test Bench
Pneumatic Test Trainer
Manual Milling Machine
Manual Lathe
Measuring Instruments for GD & T
Everett OIT Lab Facility
Engine Test Dynomometer
Heat Treat Furnace
Fluids Flow Test Trainer
Lecture Classroom w/ Projector
Reception Office / Meeting Room
Lab Space for Thermodynamics, Fluids and Heat Transfer
Hardness Tester
Tensile Tester with Computer
Torsion Test Bench
Sharpie Test Apparatus
Computerized Pressure Vessel
Strengths of Materials Lab
Radiation Heat Transfer with Furnace
Tube in Tube Heat Exchanger
Venturi - Manometers
Wind Tunnel Test Apparatus
Connective Heat Transfer
3-Axis Benchtop CNC Mill

Figure 107: Classroom/Meeting Rooms

Figure 1: Refrigeration Cycle Test Bench

Figure 108: Pneumatic Test Trainer

Figure 109:Manual Milling Machine


Figure4: Manual Lathe

Figure 5: Everett OIT Lab Facility

Figure6: Engine Test Dynomometer

Figure7: Heat Treat Furnace

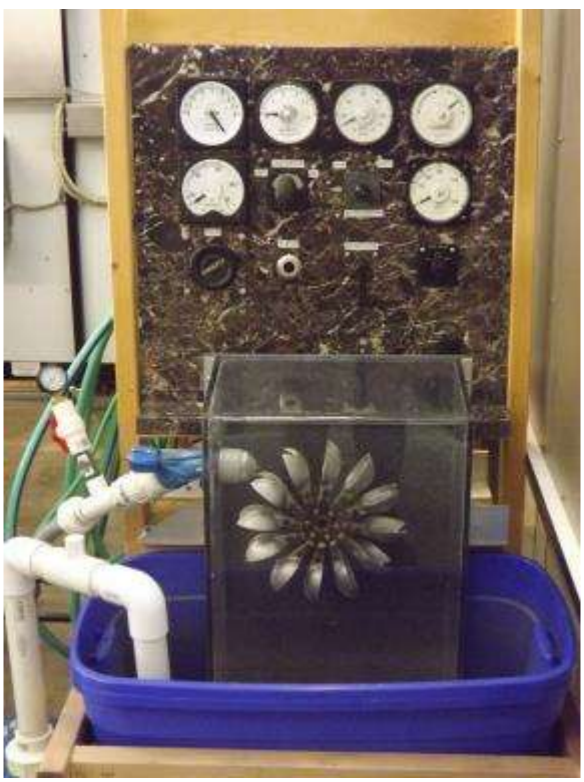

Figure 8: Fluids Flow Test Trainer

Figure 9: Lecture Classroom w/ Projector

Figure 10: Reception Office / Meeting Room

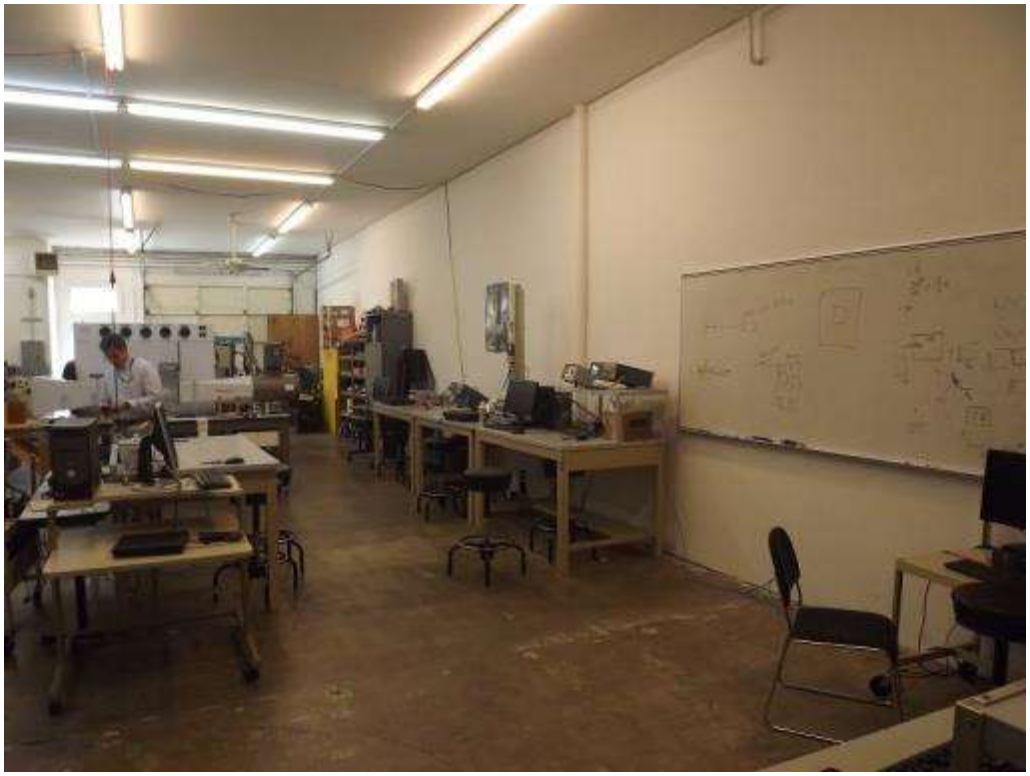

Figure 11: Lab Space for Thermodynamics, Fluids and Heat Transfer

Figure 12: Hardness Tester

Figure 13: Tensile Tester with Computer

Figure 14: Torsion Test Bench

Figure 15: Sharpie Test Apparatus

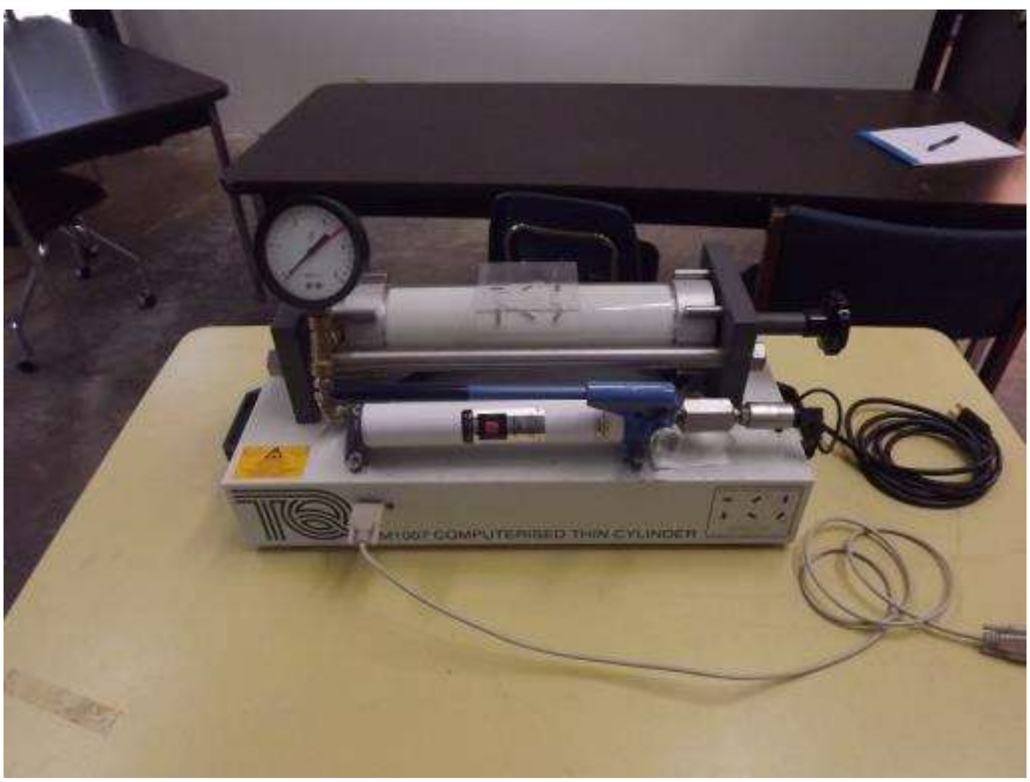

Figure 16: Computerized Pressure Vessel

Figure 17: Strengths of Materials Lab

Figure 18: Radiation Heat Transfer with Furnace

Figure 19: Tube in Tube Heat Exchanger

Figure20: Venturi - Manometers

Figure 21: Wind Tunnel Test Apparatus

Figure 22: Connective Heat Transfer

Appendix D – Institutional Summary

Appendix D will be provided in a separate document.

Appendix E Oregon Tech Policies

Effective July 1, 2015, Oregon Institute of Technology (Oregon Tech) became a separate legal entity from the Oregon University System and now operates under its own Board of Trustees. With the dissolution of the OUS System many of the Oregon Administrative Rules (OARs) specific to Oregon Tech and higher education in general were repealed.

Former OARs in Chapter 578, specific to Oregon Tech, were effectively readopted as Oregon Tech University Policies in substantially identical form on July 1, 2015. For convenience, until all policies are reviewed, the University Policies that were previously OARs will maintain their previous OAR numbers, without the “OAR” designator.

Chapter 580 of the OARs, previously promulgated by the State Board of Higher Education, were also effectively readopted as University Policies in substantially identical form on July 1, 2015. They are now also incorporated into the University Policies, retaining their previous OAR numbers without the “OAR” designator.

In addition, SBHE Internal Management Directives (IMDs) and board policies were also effectively readopted as Oregon Tech University Policies in substantially identical form on July 1, 2015.

To interpret the Policies during this transition period, note that “Board” or “State Board of Higher Education” now refers to Oregon Tech’s Board of Trustees; “Chancellor” means “University President;” “Institution” means Oregon Tech; and so on.

OREGON INSTITUTE OF TECHNOLOGY

Transfer of Credits
OIT-13-011

OIT makes every effort to give maximum consideration to the transfer work presented by students coming to OIT. In order to ensure that the student has the requisite knowledge in OIT's subject areas, OIT follows these policies in determining credit:

Accreditation Status of Institution

The institution where the transfer credit was earned must be accredited by an accrediting body that is recognized by the Council for Higher Education (CHEA).

Students transferring work from an institution that is not accredited by a CHEA-recognized accrediting body may receive transfer credit by 1) demonstrating prior experiential learning with a portfolio, 2) applying for credit after demonstrating competencies in advanced course work in the same subject area, or 3) challenging courses by exam.

International Institutions

Students seeking transfer credit from international institutions must provide OIT with a credential evaluation from an OIT-approved credential evaluation service. Credential evaluation applications may be obtained from the Director of International Student Services or the Registrar. The credential evaluation must include course titles, credits, and grades. Students must also provide course descriptions in English from the foreign institution.

Official Transcripts

Prior to the formal awarding of transfer credit, the transfer student must provide an official transcript of course work completed at all other higher education institutions. Failure to list all colleges attended on the Application for Admission may result in denial of admission or transfer credit.

Admitted transfer students must submit official transcripts at least one term prior to enrollment to ensure timely evaluation of transfer credits.

Determination of Transfer Credit

The OIT Registrar's Office determines the transfer equivalency of general education courses using articulation agreements, course descriptions, course outlines, class syllabi, ACE guides for military credit, and faculty recommendations. The student's major department determines the transfer equivalency for technical or major courses using similar resources.

Applicability of Transfer Credit

OIT provides a complete, written transfer evaluation upon the admission of the student, prior to the planned term of enrollment. The evaluation delineates the transfer credit on a course-by-course basis and specifies direct course equivalencies, courses which may be used towards general education requirements, elective credits, and courses which do not receive credit.

At the time of admission, OIT's written transfer evaluation may include elective credits that do not apply towards a specific degree. These credits will be recorded as transfer credit for registration purposes, allowing the student an earlier registration appointment based on total earned credit hours.

Some transfer work, which may not be directly equivalent to OIT courses, may be appropriately substituted to meet OIT requirements. Students may seek course substitution approval by completing the Course Waiver/Substitution form and obtaining the signature of the advisor, department chair, and Registrar.

Minimum Grade Standards

OIT considers for transfer those courses that carry a grade of "D" or better from an accredited institution. However, many OIT departments require "C" or better course grades for prerequisite and graduation purposes.

Pre-College Level Transfer Credit

OIT does not accept for transfer credit courses that are considered pre-college or vocational. OIT determines the level and nature of the course by examining the catalog description and course numbering system of the student's prior college.

Catalog of Graduation

The student must meet all degree requirements from one OIT catalog. The catalog may be chosen from the year the student is first admitted and enrolled at OIT or from any subsequent year. However, at the time of graduation all students, including transfer students, must use a catalog that is not more than seven years old.

Transfer students may select their catalog of graduation prior to full admission to OIT by obtaining written approval from their OIT major department and the Registrar. The agreed-upon catalog will be the one a student uses when he/she transfers to OIT. Students must enroll at OIT within two years of this approval.

Departments periodically review their curriculum for technical currency. As a result, significant program changes may occur. Courses previously required in the curriculum may no longer be offered. The major department will provide a transition plan for students to fulfill degree requirements.

Programs discontinued by the college may have specific entrance and graduation limits that override this policy.

Baccalaureate Upper Division Credit Requirement

Baccalaureate students must complete a minimum of 60 credits of upper-division work before a degree will be awarded. Upper-division work is defined as 300- and 400-level classes at a bachelor's degree granting institution.

College Level Examination Programs

OIT will award credit for several college-level examination programs. These examinations must be completed with a satisfactory score and an original copy of test results must be forwarded to the Registrar's Office from the testing service. In order to receive such credit, the student must be admitted to an OIT degree program and registered for classes during the quarter in which the request is made. A maximum of 25 percent of the credits used toward the degree may be CLEP and AP.

Students who complete college-level work in high school under the Advanced Placement (AP) program must achieve a minimum score of three to be granted credit on their OIT transcript. Information on AP course equivalencies may be obtained from the OIT Registrar's Office.

OIT awards credit for College-Level Examination Program (CLEP) *subject* examinations, but not for CLEP *general* examinations. Information on CLEP course equivalencies and minimum scores may be obtained from the OIT Registrar's Office.

Credit for Prior Learning

OIT awards credit for educational accomplishments attained outside of accredited postsecondary institutions. For further information regarding this type of credit, students may consult OIT's Credit by Examination policy or its Credit for Prior Learning policy, both of which may be obtained from the OIT Registrar's Office.

Credit for Alternative Delivery Courses

Courses taken by alternative delivery from other accredited institutions will be evaluated as transfer credit.

Pre-Approval of Transfer Credit

OIT students who plan to enroll at other institutions during the summer or to complete course work for the degree in absentia are encouraged to obtain written pre-approval of transfer credit to ensure transfer equivalency for degree purposes.

Recommended:

Faculty Senate – June 4, 1998
President's Council – June 9, 1998

Approved:______________________________
Martha Anne Dow, President

Date:______________________________

OREGON INSTITUTE OF TECHNOLOGY

Credit for Prior Learning
OIT-13-013

Oregon Institute of Technology recognizes that students learn outside the classroom through experiences on the job, vocational or occupational education, professional development courses and workshops, and independent study. OIT grants credit for learning, which is judged to be equivalent to college-level courses in the OIT curriculum.

Level of Credit

OIT grants credit for prior learning at the undergraduate level only.

Credit Limitations

Credit for prior learning will not be granted when the student has already received credit for the same course. No more than 25% of the credits needed for a degree or certificate may be from credit for prior learning. Credit may only be granted for courses offered by OIT and the college reserves the right to declare any course offering as inappropriate for prior learning credit.

Eligibility Requirements

The student must be fully admitted and enrolled at OIT and the student must also have completed at least 12 OIT credits with a minimum cumulative grade point average of 2.00. Credit will be granted once the student has successfully completed the procedure outlined in this policy.

Awarding of Credit

Credit will be identified on the student's transcript as credit for prior learning. This credit will not be graded or counted in the student's grade point average.

Tuition and Fees

The Extended Studies Department offers the Prior Learning Portfolio course at regular tuition rates. The application fee for a specified course is based on the current course challenge fee.

Transfer of Prior Learning Credit

OIT accepts credit for prior learning from other institutions, provided that the transfer institution awards such credit on the basis of standards similar to those outlined by the Northwest Association of Schools and Colleges.

Faculty Qualifications

Credit is awarded based on the recommendation of teaching faculty who are qualified in the subject area and who are on regular appointment with the college on a continuing basis.

Procedure

Students seeking credit for prior learning should direct initial inquiries to the Registrar. The Registrar determines whether the student has met the previously outlined eligibility requirements. If so, the Registrar signs the student's Credit for Prior Learning Application.

The student confers with the chair of the department offering the course to determine the feasibility of awarding credit through this policy. If appropriate, a departmental faculty mentor is assigned and course competencies and objectives are outlined. The mentor signs the Credit for Prior Learning Application.

The student must then complete OIT's Prior Learning Portfolio course. Students who have experience in the use of portfolios may be waived from this requirement.

The student pays the cashier a non-refundable fee and the cashier signs the student's Credit for Prior Learning Application. The fee is the same as the current course challenge fee.

The student submits the application and portfolio to the faculty mentor. The faculty mentor reviews the portfolio and interviews the student, paying particular attention to ensure that the learning experience is tied to theories, competencies, and objectives of the academic subject matter. If the faculty mentor determines that the portfolio is ready for submission, he/she initiates a meeting of the Prior Learning Review Committee. This committee consists of the faculty mentor, a second member from the department offering the course, and a faculty member certified in the use of portfolios. OIT will provide certification training to faculty members.

The committee reviews the portfolio, the faculty mentor's recommendations, and makes a decision as to whether or not to grant credit. The committee forwards its decision, along with the student's portfolio and Credit for Prior Learning Application, to the Registrar who will keep them as a part of the student's permanent academic record.

Appeals regarding the award of credit may be made to the appropriate dean.

Recommended:

Faculty Senate – 3/5/98
President's Council – 3/10/98

Approved:________________________________
Interim President

Date: March 19, 1998

Northwest Association of Schools and Colleges
Commission on Colleges
Standards

2.3 Policy on Credit for Prior Experiential Learning*

The Commission on Colleges recognizes the validity of granting credit for prior experiential learning, provided the practice is carefully monitored and documented. Credit for prior experiential learning may be offered under the conditions enumerated below. This policy is not designed to apply to such practices as CLEP, Advanced Placement, or ACE-evaluated military credit.

a. Policies and procedures for awarding experiential learning credit must be adopted, described in appropriate institutional publications, and reviewed at regular intervals.

b. Credit for prior experiential learning may be granted only at the undergraduate level.

c. Before credit for prior experiential learning becomes part of the student's permanent record, the student must complete a sufficient number of units to establish evidence of a satisfactory learning pattern.

d. Credit may be granted only upon the recommendation of teaching faculty who are appropriately qualified and who are on a regular appointment with the college on a continuing basis.

e. Credit may be granted only for documented learning that ties the prior experience to the theories and data of the relevant academic fields.

f. Credit may be granted only for documented learning that falls within the regular curricular offerings of the institution.

g. An institution that uses documentation and interviews in lieu of examinations must demonstrate in its self-study that the documentation provides the academic assurances of equivalence to credit earned by traditional means.

h. Credit for prior experiential learning may constitute no more than 25% of the credits needed for a degree or certificate.

i. No assurances are made as to the number of credits to be awarded prior to the completion of the institution's review process.

j. Credit may be granted only to enrolled students and is to be identified on the student's transcript as credit for prior experiential learning.

k. Policies and procedures must ensure that credit for prior experiential learning does not duplicate other credit awarded.

l. Adequate precautions must be provided to ensure that payment of fees does not influence the award of credit.

Adopted 1988

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*Credit for courses taken from nonaccredited institutions must be addressed pursuant to Policy 2.5 – Transfer and Award of Academic Credit.

OREGON INSTITUTE OF TECHNOLOGY

Graduation
OIT-15-011

Application for Graduation

Students must file an Application to Graduate and Petition for Graduation at least two terms prior to the term of graduation. These forms must be obtained from and returned to the Registrar's Office.

OIT Metro Center students must schedule a graduation degree check appointment with the associate director of the Metro Center at least two terms prior to graduation. The final graduation check is completed by the Registrar's Office at the Klamath Falls campus.

Grade Point Requirement

Oregon Institute of Technology requires a minimum cumulative grade point average of 2.00 for graduation.

Graduation Residency Requirements

All degrees require students to take a minimum number of OIT courses. For an associate's, a minimum of 30 term credit hours must be taken from OIT. For a bachelor's, a minimum of 45 term credit hours must be taken from OIT. Credits earned through OIT course challenge or the OIT Credit for Prior Learning program are considered resident credits toward graduation requirements. All other credits granted by examination (CLEP or AP) or other methods are non-resident credits.

Catalog of Graduation

Students must meet all degree requirements from one OIT catalog. The catalog may be chosen from the year the student is first admitted and enrolled at OIT or from any subsequent year. However, at the time of graduation all students, including transfer students, must use a catalog that is no more than seven years old.

Transfer students may select their catalog of graduation prior to full admission to OIT by obtaining written approval from their OIT major department and the Registrar. The agreed-upon catalog will be the one a student uses when he/she transfers to OIT. Students must enroll at OIT within two years of this approval.

Departments periodically review their curriculum for technical currency. As a result, significant program changes may occur. Courses previously required in the curriculum can no longer be offered. The major department will provide a transition plan for students to fulfill degree requirements.

Programs discontinued by the college may have specific entrance and graduation limits that override the catalog of graduation.

Multiple Majors

An undergraduate student may earn multiple majors if all the degree requirements for each major are met. All successfully completed majors will be listed on both the transcript and diploma.

Concurrent Degrees

Students may be granted a second bachelor's degree provided they meet the requirements for both degrees and complete an additional 36 credits beyond the requirements of the first degree. Forty-five credits are required if the first degree was not granted by OIT and students must meet the general education requirements as outlined in their catalog of graduation. If the first bachelor's degree was granted by OIT, the general education requirements are waived for the second degree.

Curricular Requirements

Curricular requirements are determined by, and vary with, the departments involved. Major requirements are published in the General Catalog.

General Education Requirements

All students must complete the college general education requirements as listed in the curriculum map for the major and in the General Catalog.

Course Substitutions

Students may seek course substitution approval by completing the Course Waiver/Substitution form and obtaining the signature of the advisor, department chair, and Registrar. Course substitutions for general education requirements must satisfy the same category of general education requirement. For example, a humanities course specified by the major department may be substituted by another humanities course, subject to the above approvals.

Commencement

Oregon Institute of Technology's graduation ceremony is held in June each year at which time degrees are granted to all who have satisfactorily completed all major and college general education requirements during the spring term. Fall and winter term graduates who have already received diplomas may also participate in commencement.

Students who demonstrate the ability to graduate in the following summer term may also participate in commencement ceremonies. However, summer graduates will not receive academic honors or diplomas at the spring commencement.

Diplomas

OIT awards diplomas at commencement, based on preliminary grades and preliminary degree checks for spring term graduates. Students who receive a diploma at commencement, but do not subsequently complete degree requirements, will be notified after the final degree check. The student will be asked to return the diploma. The college will place a hold on the student's registration privileges and transcript if the diploma is not returned.

Those students with estimated failing or incomplete grades will receive a letter, rather than a diploma, inside the diploma cover. After completion of all degree requirements, these students will receive their diplomas in the mail.

Academic Honors

At each commencement, Oregon Institute of Technology recognizes academically outstanding students who will receive their bachelor's degree with academic honors. This honor is based on all academic work presented for the degree, including transfer credits and indicates a high level of scholastic achievement. Academic honors are based on the following criteria:

- Cum Laude – graduation with honors – 3.50-3.74 grade point average
- Magna Cum Laude – graduation with high honors – 3.75-3.89 grade point average
- Summa Cum Laude – graduation with highest honors – 3.90-4.00 grade point average.

After final grades are posted, the honors standing of some students may change. If there are students whose honors standing changes, OIT will notify them and will re-issue their diplomas. In all cases, the correct honors standing will be posted on the official transcript.

Recommended:

Faculty Senate – February 5, 1998
President's Council – March 4, 1998

Approved: *<u>/s/ Martha Anne Dow</u>*
Interim President

Date: <u>March 4, 1998</u>

Appendix F Outcome Assessment Rubrics

The proficiency scale for all of the rubrics is as follows:

Proficiency Scale (see rubric)

4 High proficiency

3 Proficiency

2 Some proficiency

1 Limited or no proficiency

Rubric for Math, Science, Engineering & Technology

ETAC SLO b: An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.
EAC SLO a: Graduates will have the ability to apply mathematics, science and engineering.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Apply math principles to obtain analytical or numerical solution(s) to an engineering problem.	Unable to apply prerequisite math concepts to new problems. Makes significant errors in computation and/or logic.	With extensive guidance, applies prerequisite math concepts to new problems. Computations may not include all important elements or steps. Order may not be logical.	Applies prerequisite math concepts to new problems, but may need some guidance. Correctly performs basic computations in a logical order.	Independently applies prerequisite math concepts to new problems. Selects correct math principles. Performs correct, thorough, clear computations in a logical order.	
Apply scientific principles that govern the performance of a given process or system in engineering problem(s).	Unable to apply prerequisite scientific concepts to new problems. Makes significant errors in computation and/or logic.	With extensive guidance, applies prerequisite scientific concepts to new problems. Computations may not include all important elements or steps. Order may not be logical.	Applies prerequisite scientific concepts to new problems, but may need some guidance. Correctly performs basic computations in a logical order.	Independently applies prerequisite scientific concepts to new problems. Selects correct scientific principles. Performs computations in a logical order.	
Apply engineering principles that govern the performance of a given process or system in engineering problem(s).	Unable to apply prerequisite engineering concepts to new problems. Makes significant errors in computation and/or logic.	With extensive guidance, applies prerequisite engineering concepts to new problems. Computations may not include all important elements or steps. Order may not be logical.	Applies prerequisite engineering concepts to new problems, but may need some guidance. Correctly performs basic computations in a logical order.	Independently applies prerequisite engineering concepts to new problems. Selects correct engineering principles. Performs computations in a logical order.	
Apply appropriate technology tools (software, equipment, CAD, CNC, instrumentation, etc.) for a given process or system to an engineering problem.	Unable to select and apply appropriate technology tools or does not demonstrate understanding of tools selected.	With extensive guidance, selects and properly applies appropriate technology tools. Demonstrates some understanding of tools selected.	Selects and properly applies appropriate technology tools, but may need guidance. Demonstrates basic understanding of tools selected.	Independently selects and properly applies appropriate technology tools. Demonstrates thorough understanding of tools selected.	

Rubric for Experiments

ETAC-c: ability to conduct, analyze and interpret experiments and apply experimental results to improve processes
EAC-b: Graduates will have the ability to design and conduct experiments, as well as to analyze and interpret data.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Ability to conduct experiments	Has trouble carrying out pre-defined experiments.	Able to conduct experiments with some direction.	Able to set up and carry through pre-defined experiments obtaining useful data.	Able to conduct experiments obtaining solid data appropriate to the investigation at hand.	
Ability to analyze and interpret data	Has difficulty analyzing experimental data. Presentation and reporting of results is confusing and hard to follow.	Able to analyze experimental data with general direction and guidance.	Ability to analyze experimental data. Can present and report results in an orderly and understandable manner.	Shows ability to analyze experimental data independently extracting and presenting insightful results.	
Ability to use experimental results to improve processes	Has trouble applying experimental results to improve processes.	Able to use results to improve processes with significant guidance.	Can use results to improve processes with guidance.	Has ability to apply experimental results to improve processes.	

Rubric for Designing a System, Component or Process

ETAC SLO d: An ability to apply creativity in the design of systems, components or processes within realistic constraints.
EAC SLO c: Graduates will be able to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Identify an appropriate set of realistic constraints and performance criteria.	A large number of codes, standards or performance criteria are missing or unclear.	Is able to identify some codes & standards, but important elements are missing. Identifies & documents some performance criteria, but important elements are missing or unclear.	Presents basic relevant codes & standards. Identifies and documents performance criteria in a basic manner.	Thoroughly presents most important, relevant codes & standards applying to project. Clearly identifies & documents in-depth performance criteria.	
Generate one or more creative solutions to meet the criteria and constraints.	Is unable to generate a creative, workable, usable, or realistic solution. Does not recognize constraints or identify criteria.	Generates a solution but does not demonstrate creativity or the ability to think through alternatives. Design may not be workable, usable or realistic. Misses important constraints or criteria.	Generates a basic solution demonstrating creativity in the design. Recognizes basic criteria and constraints.	Generates one or more workable, usable, or creative solutions. Demonstrates ability to see unique alternatives. Recognizes and addresses constraints thoroughly.	
Create a detailed design within realistic constraints.	Is unable to create a design with sufficient detail or documentation. Does not address constraints.	Design has some, but inadequate detail or documentation or does not address constraints.	Creates design with adequate detail and documentation. Incorporates and addresses constraints.	Applies engineering principles. Creates design with high level of detail and appropriate documentation. Thoroughly addresses constraints.	
Plan and manage a small technical project.	Does not develop a task/timeline, does not implement project with success, or does not provide documentation. Does not meet deadline.	Defines task and timeline with some elements missing or unrealistic. Implements project but misses important elements. Documentation is provided but needs more detail. May not meet deadline.	Defines basic tasks and timelines, implements project, including testing and basic documentation, meets deadline.	Defines realistic and detailed tasks and timelines, implements project in exemplary fashion, performs thorough testing, documents important procedures or processes in detail, completes plan on time.	

Rubric for Multidisciplinary Teamwork

ETAC e: An ability to function effectively as a member or leader on a technical team.

EAC d: an ability to function on multidisciplinary teams

OIT Team and Group Work Rubric, p. 1 of 2

Performance Criteria	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score:
1. Identifies and Achieves goal/purpose	Clear goals are not formulated or documented; thus all members don't accept or understand the purpose/task of the group. Group does not achieve goal.	Individuals share some goals but a common purpose may be lacking. Priorities may be unrealistic and documentation may be incomplete. Group may not achieve goal.	Group shares common goals and purpose. Some priorities may be unrealistic or undocumented. Group achieves goal.	When appropriate, realistic, prioritized and measurable goals are agreed upon and documented and all team members share the common objectives/purpose. Team achieves goal.	
2. Assumes and fulfills roles and responsibilities as appropriate	Members do not fulfill roles and responsibilities. Leadership roles are not defined and/or shared. Members are not self-motivated and assignments are not completed on time. Many members miss meetings.	Some members may not fulfill roles and responsibilities. Leadership roles are not clearly defined and/or effectively shared. Some members are not motivated and some assignments are not completed in a timely manner. Meetings rarely include most members.	Members often fulfill roles and responsibilities. Leadership roles are generally defined and/or shared. Generally, members are motivated and complete assignments in a timely manner. Many members attend most meetings.	Members consistently and effectively fulfill roles and responsibilities. Leadership roles are clearly defined and/or shared. Members move team toward the goal by giving and seeking information or opinions, and assessing ideas and arguments critically. Members are all self-motivated and complete assignments on time. Most members attend all meetings.	
3. Interacts and communicates effectively with team/group members	Members do not communicate openly and respectfully. Members do not listen to each other. Communication patterns undermine teamwork	Members may not consistently communicate openly and respectfully. Members may not listen to each other.	Members usually communicate openly and respectfully. Members often listen to most ideas. Members usually support and encourage each other.	Members always communicate openly and respectfully. Members listen to each other's ideas. Members support and encourage each other. Communication patterns foster a positive climate that motivates the team and builds cohesion and trust.	

OIT Team and Group Work Rubric, p. 2 of 2					
Performance Criteria	**No/Limited Proficiency (1)**	**Some Proficiency (2)**	**Proficiency (3)**	**High Proficiency (4)**	**Score:**
4. Reconcile Disagreement	Members do not welcome disagreement. Difference often results in voting. Subgroups are present.	Few members welcome disagreement. Difference often results in voting. Some members respect and accept disagreement and work to account for differences. Subgroups may be present.	Many members welcome disagreement and use difference to improve decisions. Most members respect and accept disagreement and work to account for differences. Subgroups rarely present.	All members welcome disagreement and use difference to improve decisions. All members respect and accept disagreement and employ effective conflict resolution skills. Subgroups absent.	
5. Share Appropriately	Contributions are unequal. Certain members dominate discussions, decision making, and work. Some members may not contribute at all. Individuals work on separate sections of the work product, but have no coordinating effort to tie parts together.	Contributions are unequal although all members contribute something to discussions, decision making and work. Coordination is sporadic so that the final work product is of uneven quality.	Many members contribute to discussions, decision-making and work. Individuals focus on separate sections of the work product, but have a coordinator who ties the disparate parts together (they rely on the sum of each individual's work)	All members contribute significantly to discussions, decision making and work. The work product is a collective effort; team members have both individual and mutual accountability for the successful completion of the work product.	
6. Develop Strategies for Effective Action	Members seldom use decision making processes to decide on action. Individuals often make decisions for the group. The group does not share common norms and expectations for outcomes. Group fails to reach consensus on most decisions. Group does not produce plans for action.	Members sometimes use decision making processes to decide on action. Some of the members of the group do not share norms and expectations for outcomes. Group sometimes fails to reach consensus. Plans for action are informal and often arbitrarily assigned.	Members usually use effective decision making processes to decide on action. Most of the group shares norms and expectations for outcomes. Group reaches consensus on most decisions and produces plans for action.	Members use effective decision making processes to decide on action. Group shares a clear set of norms and expectations for outcomes. Group reaches consensus on decisions and produces detailed plans for action.	
7. Cultural Adaptation	Members do not recognize differences in background or communication style.	Members may recognize, but do not adapt to differences in background and communication style	Members usually recognize and adapt to differences in background and communication style.	Members always recognize and adapt to differences in background and communication style.	

Rubric for Solving Engineering Problems

ETAC SLO f: An ability to identify, formulate, analyze and solve engineering problems.
EAC SLO e: Graduates will be able to identify, formulate, and solve engineering problems.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Identify an engineering problem.	Does not identify the problem clearly.	Defines problem but has missing elements or does not include important information.	Adequately defines problem, including sufficient basic information.	Clearly identifies problem or reiterates given problem, including underlying principles and scope. Demonstrates depth of understanding.	
Make appropriate assumptions.	Does not identify assumptions or constraints, or makes errors in attempting to do so.	Identifies some assumptions and constraints but important elements are missing.	Identifies basic assumptions and constraints.	Clearly delineates realistic constraints & important assumptions that affect solution. Includes assumptions that are workable, usable, and/or valid.	
Formulate a plan which will lead to a solution.	Does not develop a coherent plan to solve the problem.	Develops a marginal plan with some important elements missing.	Develops an adequate plan that leads to a plausible solution.	Develops a coherent and concise plan to solve the problem with alternative strategies and a clear path to solution. Plan smoothly flows from problem statement and assumptions.	
Apply engineering principles to analyze the problem.	Does not use appropriate principles for analysis.	Performs a partial analysis, with some important elements or analyses missing.	Performs basic analysis using appropriate principles to solve problem.	Correctly applies analytical tools or techniques and analyzes problem in depth. Clearly solves the problem.	
Document results in an appropriate format.	Does not follow format or does not include understandable documentation.	Follows format but has missing elements. Documentation is incomplete or unclear.	Follows format and produces understandable documentation.	Follows given format in detail. Documentation is clear, understandable, polished and organized.	

Rubric for an Understanding of professional and Ethical Responsibility

ETAC-i: an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity
EAC f: An understanding of professional and ethical responsibility

OIT Ethics Rubric

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
Demonstrates knowledge of the professional code of ethics	Identifies provisions in the professional code of ethics, but is unable to demonstrate importance or relevance to the profession.	Describes the importance of provisions, but some examples do not apply or fail to illustrate importance of the specified provision.	Describes the importance of provisions in the professional code of ethics. Examples are applicable to the specified provisions and illustrate importance.	Describes in detail the importance of provisions in the professional code of ethics and relevance to the profession. Examples are applicable to the specified provisions and illustrate importance.	
Using code of ethics, describes ethical issue(s)	Has a vague idea of what the issue is and is uncertain how the code of ethics applies.	Describes the issue(s) using concepts from code of ethics, but important elements may be missing or misunderstood.	Describes the issue(s) using basic concepts from code of ethics.	Describes the issue(s) in detail, demonstrating full understanding of relevant code of ethics provisions and how they relate to the issue(s).	
Describes parties involved and discusses their points of view	Is unsure who should be involved in the issue and/or does not reflect on their viewpoints.	Describes some of the parties and their viewpoints, but important elements are missing or misunderstood.	Describes who should be involved in the issue(s) and discusses the viewpoints of the parties at a basic level.	Describes who should be involved in the issue(s) and thoroughly discusses their viewpoints.	
Describes and analyzes possible/ alternative approaches	Is unable to describe or analyze alternatives or consider the effect on parties involved.	Describes and analyzes only one alternative and its effect on parties involved, but important elements are missing or misunderstood.	Describes and analyzes at least two alternatives and their effects on parties involved.	Describes and analyzes a number of alternative approaches and thoroughly considers the interests and concerns of all parties involved.	
Chooses an approach and explains the benefits and risks	Has difficulty choosing an approach or stating benefits and risks.	Chooses an approach and explains benefits and risks, but important elements are missing or misunderstood.	Chooses an approach and explains basic benefits and risks.	Chooses an approach and thoughtfully and thoroughly explains benefits and risks.	
Demonstrates knowledge and understanding of "ethical diversity"	Demonstrates none or minimal understanding of ethical diversity. Does not recognize biases.	Demonstrates a partial understanding of ethical diversity and recognition of biases.	Demonstrates adequate understanding of ethical diversity and recognition of biases.	Demonstrates a complete understanding of ethical diversity and the recognition of biases.	

OIT Public Speaking Rubric				
Performance Criteria	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)
Content	Few or no attributed sources. Supporting materials lack credibility and/or don't relate to thesis. Limited or no attempt to inform or persuade.	Some attributed sources used. Supporting materials are somewhat credible and/or don't clearly relate to thesis. Attempt to inform or persuade.	Adequate number of credible and appropriately attributed sources used. Supporting materials relate to thesis. Informs or persuades.	A variety of credible and appropriate sources used. Supporting materials relate in an exceptional way to a focused thesis. Informs or persuades.
Organization	Lacks organizational structure. Introduction and/or conclusion missing. No transitions used.	Organizational structure present but unclear with underdeveloped introduction and conclusion. Transitions are awkward.	Appropriate organizational pattern used and easy to follow with developed introduction and satisfying conclusion. Main points are smoothly connected with transitions.	Organizational pattern is compelling and moves audience through speech with ease. Introduction draws in the audience and conclusion is satisfying. Main points are smoothly connected with transitions.
Style	No understanding of audience regarding topic or purpose of speech. Little enthusiasm and passion for topic. No regard for time constraints.	Some understanding of audience regarding topic or purpose of speech. Some enthusiasm and passion for topic. Some regard for time constraints.	Competent understanding of audience regarding topic and purpose. Enthusiasm and passion for topic. Speech given within time constraints.	Thorough understanding of audience regarding topic and purpose. Clear enthusiasm and passion for topic. Speech given within time constraints.
Delivery	No gestures or eye contact. Monotone voice or insufficient volume. Little poise. Reading of notes only. Abundant oral fillers and nonverbal distractions.	Some gestures and eye contact. Ineffective use of language and voice. Little poise. Heavy reliance on notes. Multiple oral fillers and nonverbal distractions.	Adequate use of gestures, eye contact, language, and voice. Poised with minor reliance on notes. Limited oral fillers and nonverbal distractions.	Effective use of gestures, eye contact, vivid language, and voice to add interest to speech. Poised with use of notes for reference only. No oral fillers and nonverbal distractions.
Visuals	No visuals or poorly-designed and documented visuals that distract from speech or do not create interest. Limited reference to visuals or so much reference delivery is hindered.	Visuals present, but simply designed with limited use of documentation. Visuals are referred to but do not create interest. Visuals may interfere with delivery.	Well-designed and documented visuals that clarify speech and create interest. Visuals are referred to and sufficiently discussed, while not interfering with delivery.	Well-designed and documented visuals that clarify speech, create interest, and hold attention of the audience. Visuals are sufficiently discussed and effectively integrated into speech.

OIT Essay Rubric

Performance Criteria	Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)
Purpose and Ideas	Writing has limited or no focus. Purpose and main ideas are unclear and require inference from reader.	Reader can discern the purpose and main ideas although they may be overly broad or simplistic.	Writing is clear and focused. Reader can easily understand the purpose and main ideas.	Purpose and main ideas are exceptionally focused, clear, and interesting.
Organization	Order and structure are unclear. Introduction and conclusion are underdeveloped or missing.	Order and structure are overly formulaic. Introduction and conclusion may be underdeveloped or too obvious.	Order and structure are clear and easy to follow. Introduction draws in the reader and conclusion brings satisfying closure.	Order and structure are compelling and move the reader through the text easily. Introduction draws in the reader and conclusion brings satisfying closure.
Support	Development is minimal. Some supporting details may be irrelevant or repetitious.	Supporting details are relevant, but are limited or rather general. Support may be based on clichés, stereotypes, or questionable sources or evidence.	The main ideas are well developed by supporting details. When appropriate, use of outside sources provides credible support.	Main ideas are well developed by strong support and rich details. When appropriate, use of outside sources provides strong, credible support.
Style	Voice is inappropriate for topic, purpose, or audience. Wording is incorrect or monotonous, detracting from impact. Sentences tend to be choppy, rambling, and awkward.	Voice is inconsistent for topic, purpose, and audience. Wording is quite ordinary, lacking interest, precision, and variety, and may rely on clichés. Sentences tend to be mechanical rather than fluid with an overuse of simple sentence structures.	Voice is generally appropriate for topic, purpose, and audience. Generally, wording conveys message in an interesting, precise, and natural way. Sentences are carefully crafted with variations in structure.	Voice is appropriate for topic, purpose, and audience. Wording is fresh and specific, with a striking and varied vocabulary. Sentences are highly crafted, with varied structure that makes reading easy and enjoyable.
Conventions	Numerous errors in usage, spelling, punctuation, and/or grammar. Errors sometime impede readability. Substantial editing needed.	Writing contains punctuation, spelling, and/or grammar errors, but they do not impede readability and are not extensive. Moderate need for editing.	Writing demonstrates control of standard writing conventions and uses them effectively to enhance communication. Few errors.	Writing demonstrates strong control of standard writing conventions and uses them well to enhance communication. Very few or no errors.
Documentation	Documentation has major errors or is not present.	Documentation has frequent errors.	Documentation is correct except for a few errors.	Documentation is meticulous.

IMPACT of ENGINEERING ASSESSMENT RUBRIC

ETAC (j): a knowledge of the impact of engineering technology solutions in a societal and global contex

EAC (h): the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
Understands the global impact of engineering decisions	Does not understand that engineering solutions have a global impact.	Realizes that engineering solutions have a global impact but has difficulty giving examples.	Understands engineering decisions have a global impact and can explain several examples.	Understands engineering decisions have a global impact, can analyze examples, and can reflect on impact of proposed engineering solutions.	
Understands the macro-economic impact of engineering solutions	Has little or no understanding of macro-economics.	Has little understanding of macro-economics and the effects of engineering solutions. Can not give examples of such impacts.	Has some understanding of macro-economics and the impacts on it from engineering solutions. Can give examples.	Has an understanding of macro-economics and the impact of engineering solution on it. Can explain examples and reflect on the impact new solutions may have.	
Understands the environmental and the social impact of engineering decisions	Does not believe that engineering decisions have a social or environmental impact.	Believes engineering solutions have a social and/or environmental impact but can't relate this to a particular situation.	Understands engineering decisions have social and/or environmental impacts. Can describe examples.	Understands engineering decisions have social and/or environmental impacts. Can relate this knowledge to a current situation.	

OIT Lifelong Learning Rubric

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
1. Lifelong learning	Fails to identify the need for "lifelong learning" and/or omits discussion of their own learning and relevant examples.	Misses important elements in discussing "lifelong learning," applying concepts to their own learning or providing a relevant example.	Defines the concept of "lifelong learning." Demonstrates self-awareness by accurately identifying strengths/ weaknesses in their own ability to learn independently. Gives a relevant example.	Defines the concept of "lifelong learning" and its importance. Demonstrates self-awareness by accurately discussing strengths/ weaknesses in their own ability to learn independently. Gives relevant example(s).	
2. Professional Development	Fails to identify professional development opportunities.	Discusses professional development opportunities that are either inappropriate or irrelevant.	Identifies appropriate professional development opportunities.	Identifies and thoroughly discusses appropriate professional development opportunities.	
3. Short- and long-term career plans	Vaguely describes career goals and/or does not include a plan to meet them.	Career goals after graduation do not include both long and short term plans and/or the plan is unrealistic.	Describes short- and long-term career goals after graduation. Includes a realistic plan to meet these goals.	Describes short- and long-term career goals after graduation. Includes a realistic, thorough, and thoughtful plan to meet these goals.	

Rubric for Contemporary Issues

EAC SLO j: Graduates will have knowledge of contemporary issues.

Performance Criteria	Limited or No Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Score
Address major socio-economic issues	Little or no understanding (or interest). Unable to put forth more than one side to an issue.	Moderate understanding of national and international issues. Can follow but has trouble expressing more than one side of an issue.	Good understanding of many issues. Understands and can express more than one side of an issue.	Deep understanding of the immediate and long-term implications. Articulately expresses arguments from several viewpoints including the historical perspective.	
Address US political issues	Little or no understanding (or interest). Unable to put forth more than one side to an issue.	Moderate understanding. Rudimentary understanding of current political issues.	Good understanding. Can express and explain different sides of political issues.	Deep understanding. Can knowledgeably explain current political issues, the underlying problems, and historical perspective.	

Rubric for Use of Techniques, Skills, and Modern Engineering Tools

TAC SLO a: An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines

EAC SLO k: Graduates will be able to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Use computers and a wide range of programs effectively	Marginal ability with word processor and spreadsheet use. Struggles with other programs and programming	Able to use word processors and spreadsheets to produce reports. Has difficulty with other programs	Able to use word processors and spreadsheets to produce well formatted reports. Able to use other programs and write computer programs	Skilled at word processing and spreadsheet use. Skilled with other programs and able to write longer intricate programs	
Appropriate mastery of modern engineering tools.	Able to use modern engineering tools with close supervision. Marginal understanding of modern engineering tools.	Able to use modern engineering tools with supervision.	Skilled at using modern engineering tools.	Able to direct others in the use of modern engineering tools. Skilled at using modern engineering tools.	
Use the techniques and skills necessary for engineering practice	Has little or no understanding of engineering methods.	Some understanding of engineering methods, but has trouble selecting appropriate techniques and designing parts.	Understands basic engineering methods and can, with assistance, design parts.	Has a broad understanding of engineering methods. Able to design parts using engineering techniques and skills.	

Rubric for Work Professionally in Thermal Systems

EAC SLO m1: An ability to work professionally in the area of thermal systems

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Identify an engineering problem	Does not identify the problem.	Defines problem but has missing elements or does not include important information	Adequately defines problem, including sufficient basic information.	Clearly identifies problem or reiterates given problem, including underlying principles and scope. Demonstrates depth of understanding.	
Make appropriate assumptions.	Does not identify assumptions or constraints, or makes errors in attempting to do so.	Identifies some assumptions and constraints but important elements are missing.	Identifies basic assumptions and constraints.	Clearly delineates realistic constraints & important assumptions that affect solution. Includes assumptions that are workable, usable, and/or valid.	
Formulate a plan with will lead to a solution.	Does not develop a coherent plan to solve the problem.	Develops a marginal plan with some important elements missing.	Develops an adequate plan that leads to a plausible solution.	Develops a coherent and concise plan to solve the problem with alternative strategies and a clear path to solution. Plan smoothly flows from problem statement and assumptions.	
Apply engineering principles to analyze the problem.	Does not use appropriate principles for analysis.	Performs a partial analysis, with some important elements or analyses missing.	Performs basic analysis using appropriate principles to solve problem.	Correctly applies analytical tools or techniques and analyzes problem in depth. Clearly solves the problem.	
Document results in a appropriate format.	Does not follow format or does not include understandable documentation.	Follows format but has missing elements. Documentation is incomplete or unclear.	Follows format and produces understandable documentation.	Follows given format in detail. Documentation is clear, understandable, polished and organized.	

Rubric for Work Professionally in Mechanical Systems

EAC SLO m2: An ability to work professionally in the area of mechanical systems

Performance Criteria	(1) Limited or No Proficiency	(2) Some Proficiency	(3) Proficiency	(4) High Proficiency	Score
Identify an engineering problem	Does not identify the problem.	Defines problem but has missing elements or does not include important information	Adequately defines problem, including sufficient basic information.	Clearly identifies problem or reiterates given problem, including underlying principles and scope. Demonstrates depth of understanding.	
Make appropriate assumptions.	Does not identify assumptions or constraints, or makes errors in attempting to do so.	Identifies some assumptions and constraints but important elements are missing.	Identifies basic assumptions and constraints.	Clearly delineates realistic constraints & important assumptions that affect solution. Includes assumptions that are workable, usable, and/or valid.	
Formulate a plan with will lead to a solution.	Does not develop a coherent plan to solve the problem.	Develops a marginal plan with some important elements missing,.	Develops an adequate plan that leads to a plausible solution.	Develops a coherent and concise plan to solve the problem with alternative strategies and a clear path to solution. Plan smoothly flows from problem statement and assumptions.	
Apply engineering principles to analyze the problem,.	Does not use appropriate principles for analysis.	Performs a partial analysis, with some important elements or analyses missing.	Performs basic analysis using appropriate principles to solve problem.	Correctly applies analytical tools or techniques and analyzes problem in depth. Clearly solves the problem.	
Document results in a appropriate format.	Does not follow format or does not include understandable documentation.	Follows format but has missing elements. Documentation is incomplete or unclear.	Follows format and produces understandable documentation.	Follows given format in detail. Documentation is clear, understandable, polished and organized.	

OUTCOME (a): Mathematics, Science & Core Engineering

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04	E	MATH 252	E	MATH 341	E	MECH 323	R
	ENGR 111	I	MET 242	E	MECH 318	R	MECH 351	R
	WRI 121		PHY 221	E	MECH 363	E	MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375	E	WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	R
							MECH Elec	
Winter	CHE 202/05	E	ENGR 211	E	ENGR 212	E	MECH 437	R
	MFG 103		MATH 254N	E	ENGR 355	E	MECH 480	R
	WRI 122		Statistics	E	MECH 315	R	MECH 491	R
	Hum/Soc Sci		PHY 222	E	MECH 360	R	PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251	E	ENGR 213	E	HUM 125		MGT 345	
	MFG 120		ENGR 236	E	MATH 451	E	MECH 436	R
	MET 160	E	ENGR 266	E	MECH 313		MECH 492	R
	MET 241	E	MATH 321	E	MECH 316		Hum/Soc Sci	
	SPE 111		PHY 223	E	MECH Elec		MECH Elec	

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (b): Experiments

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04	I	MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318	E	MECH 351	
	WRI 121		PHY 221	R	MECH 363	E	MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05	I	ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355		MECH 480	E
	WRI 122		Statistics	R	MECH 315		MECH 491	R
	Hum/Soc Sci		PHY 222	R	MECH 360	R	PHIL 331	
					MET 326	R	Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213	R	HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451	R	MECH 436	R
	MET 160	I	ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	
	SPE 111		PHY 223	R	MECH Elec		MECH Elec	

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OUTCOME (c): Design of System, Components, or Processes

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	R
	ENGR 111	I	MET 242	R	MECH 318	R	MECH 351	R
	WRI 121		PHY 221		MECH 363	R	MECH 490	E
	Hum/Soc Sci		WRI 227		MET 375	R	WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	R
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212	R	MECH 437	R
	MFG 103		MATH 254N		ENGR 355	R	MECH 480	R
	WRI 122		Statistics		MECH 315	R	MECH 491	E
	Hum/Soc Sci		PHY 222		MECH 360		PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213	R	HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451	R	MECH 436	R
	MET 160		ENGR 266		MECH 313	R	MECH 492	E
	MET 241	R	MATH 321		MECH 316	E	Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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E = Emphasized

OUTCOME (d): Multidisciplinary Teams

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318	R	MECH 351	
	WRI 121		PHY 221	I	MECH 363	R	MECH 490	E
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355		MECH 480	R
	WRI 122		Statistics		MECH 315		MECH 491	E
	Hum/Soc Sci		PHY 222	R	MECH 360		PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321	R	MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	R
	MET 160	I	ENGR 266		MECH 313		MECH 492	E
	MET 241		MATH 321		MECH 316	R	Hum/Soc Sci	
	SPE 111		PHY 223	R	MECH Elec		MECH Elec	

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (e): Identify, Formulate, and Solve Engineering Problems

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	E
	ENGR 111	I	MET 242		MECH 318	E	MECH 351	E
	WRI 121		PHY 221		MECH 363	E	MECH 490	E
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	E
							MECH Elec	E
Winter	CHE 202/05		ENGR 211		ENGR 212	E	MECH 437	E
	MFG 103		MATH 254N		ENGR 355	E	MECH 480	E
	WRI 122		Statistics		MECH 315	E	MECH 491	E
	Hum/Soc Sci		PHY 222		MECH 360	E	PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	E
Spring	MATH 251		ENGR 213	E	HUM 125		MGT 345	
	MFG 120		ENGR 236	E	MATH 451	E	MECH 436	E
	MET 160	I	ENGR 266	E	MECH 313	E	MECH 492	E
	MET 241		MATH 321		MECH 316	E	Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec	E	MECH Elec	E

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E = Emphasized

OUTCOME (f): Professional and Ethical Responsibility

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318		MECH 351	
	WRI 121		PHY 221		MECH 363		MECH 490	E
	Hum/Soc Sci	R	WRI 227		MET 375		WRI 327	
			Econ Elec	R	MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	
	WRI 122		Statistics		MECH 315		MECH 491	E
	Hum/Soc Sci	R	PHY 222		MECH 360		PHIL 331	E
					MET 326		Hum/Soc Sci	R
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	E	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313	R	MECH 492	E
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	R
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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E = Emphasized

OUTCOME (g): Communications

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318	E	MECH 351	
	WRI 121	E	PHY 221	R	MECH 363	E	MECH 490	R
	Hum/Soc Sci	R	WRI 227	E	MET 375		WRI 327	E
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355		MECH 480	E
	WRI 122	E	Statistics		MECH 315		MECH 491	
	Hum/Soc Sci	R	PHY 222	R	MECH 360	R	PHIL 331	R
					MET 326		Hum/Soc Sci	R
					SPE 321	E	MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	R	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	R
	MET 160		ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316	R	Hum/Soc Sci	R
	SPE 111	E	PHY 223	R	MECH Elec		MECH Elec	

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R = Reinforced
E = Emphasized

OUTCOME (h): Impact of Engineering Solutions

	Freshman		*Sophomore*		*Junior*		*Senior*	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318		MECH 351	
	WRI 121		PHY 221		MECH 363		MECH 490	E
	Hum/Soc Sci	R	WRI 227	R	MET 375		WRI 327	R
			Econ Elec	R	MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	
	WRI 122	I	Statistics		MECH 315	R	MECH 491	E
	Hum/Soc Sci	R	PHY 222		MECH 360		PHIL 331	E
					MET 326		Hum/Soc Sci	R
					SPE 321	R	MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	E	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313	R	MECH 492	E
	MET 241		MATH 321		MECH 316	R	Hum/Soc Sci	R
	SPE 111	R	PHY 223		MECH Elec		MECH Elec	

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (i): Life-Long Learning

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318		MECH 351	
	WRI 121		PHY 221		MECH 363		MECH 490	R
	Hum/Soc Sci	R	WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	
	WRI 122		Statistics		MECH 315		MECH 491	R
	Hum/Soc Sci	R	PHY 222		MECH 360		PHIL 331	E
					MET 326		Hum/Soc Sci	R
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	E	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	R
	SPE 111		PHY 223		MECH Elec		MECH Elec	

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (j): Contemporary Issues

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242		MECH 318		MECH 351	
	WRI 121	I	PHY 221		MECH 363		MECH 490	R
	Hum/Soc Sci	R	WRI 227	R	MET 375		WRI 327	R
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	
	WRI 122	I	Statistics		MECH 315		MECH 491	R
	Hum/Soc Sci	R	PHY 222		MECH 360		PHIL 331	E
					MET 326		Hum/Soc Sci	R
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125	E	MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	R
	SPE 111	R	PHY 223		MECH Elec		MECH Elec	

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OUTCOME (k): Techniques, Skills, and Modern Tools

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111	I	MET 242	E	MECH 318	E	MECH 351	E
	WRI 121		PHY 221		MECH 363	E	MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375	E	WRI 327	
			Econ Elec		MFG 314	R	MECH 417 or 418	R
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355		MECH 480	E
	WRI 122		Statistics		MECH 315		MECH 491	R
	Hum/Soc Sci		PHY 222		MECH 360	E	PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451	R	MECH 436	E
	MET 160	E	ENGR 266	E	MECH 313		MECH 492	R
	MET 241	E	MATH 321		MECH 316		Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec		MECH Elec	

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R = Reinforced
E = Emphasized

OUTCOME (m1): Thermal Systems Professional Work

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	E
	ENGR 111		MET 242		MECH 318	E	MECH 351	
	WRI 121		PHY 221		MECH 363	R	MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	E
							MECH Elec	
Winter	CHE 202/05		ENGR 211		ENGR 212		MECH 437	E
	MFG 103		MATH 254N		ENGR 355	E	MECH 480	
	WRI 122		Statistics		MECH 315		MECH 491	R
	Hum/Soc Sci		PHY 222	I	MECH 360		PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213		HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	
	MET 160		ENGR 266		MECH 313	E	MECH 492	R
	MET 241		MATH 321		MECH 316		Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec		MECH Elec	

I = Introduced
R = Reinforced
E = Emphasized

OUTCOME (m2): Mechanical Systems Professional Work

	Freshman		***Sophomore***		***Junior***		***Senior***	
Fall	CHE 201/04		MATH 252		MATH 341		MECH 323	
	ENGR 111		MET 242		MECH 318		MECH 351	E
	WRI 121		PHY 221	I	MECH 363		MECH 490	R
	Hum/Soc Sci		WRI 227		MET 375		WRI 327	
			Econ Elec		MFG 314		MECH 417 or 418	
							MECH Elec	
Winter	CHE 202/05		ENGR 211	R	ENGR 212	E	MECH 437	
	MFG 103		MATH 254N		ENGR 355		MECH 480	E
	WRI 122		Statistics		MECH 315	E	MECH 491	R
	Hum/Soc Sci		PHY 222		MECH 360		PHIL 331	
					MET 326		Hum/Soc Sci	
					SPE 321		MECH Elec	
Spring	MATH 251		ENGR 213	E	HUM 125		MGT 345	
	MFG 120		ENGR 236		MATH 451		MECH 436	E
	MET 160		ENGR 266		MECH 313		MECH 492	R
	MET 241		MATH 321		MECH 316	E	Hum/Soc Sci	
	SPE 111		PHY 223		MECH Elec		MECH Elec	

I = Introduced
R = Reinforced
E = Emphasized