ABET
Self-Study Report

for the

Mechanical Engineering Program

at

Oakland University

Rochester, MI

June 28, 2014

CONFIDENTIAL

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Program Self-Study Report for
EAC of ABET
Reaccreditation

BACKGROUND INFORMATION

- Definitions used in the Self-Study:
    - **OU** - Oakland University
    - **ME** – Mechanical Engineering (referring to department, faculty, students or programs)
    - **SECS** - School of Engineering and Computer Science
    - **ME –** Mechanical Engineering
    - **ECE –** Electrical and Computer Engineering
    - **ISE –** Industrial and Systems Engineering
    - **CSE –** Computer Science and Engineering
    - **UGCC** - SECS Undergraduate Curriculum Committee. Responsible for leading and coordinating the accreditation process; composed of members from the four departments, the Assessment coordinator (ex officio), and the Associate Dean (ex officio).
    - **DUAC** - Department Undergraduate Affairs Committee
    - **MEUAC** - Mechanical Engineering Undergraduate Affairs Committee (This is the DUAC for the ME Department
    - **PEO -** Program Educational Objectives - A set of skills that SECS graduates are expected to demonstrate 3-5 years post-graduation.
    - **SO** - Student Outcomes - A set of skills that SECS students are expected to demonstrate as they graduate.
    - **Course Objectives** – A set of educational goals for a particular SECS course.
    - **MUC** – The Macomb University Center of the Macomb Community College
    - **EC** – New Engineering Center scheduled to open Fall 2014
    - **Exhibits –** Documents appended to the end of this report.

A. Contact Information

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B. Program History

Located near the world headquarters and engineering centers of Chrysler Group, LLC, Ford Motor Co., General Motors Company as well as of over one hundred automotive suppliers in southeast Michigan, Oakland University was created in 1957 when the late Alfred G. and Matilda R. Wilson donated $2 million and their 1,500-acre estate to Michigan State University to begin a new college in Oakland County. Named Michigan State University-Oakland, the new campus enrolled its first students in 1959.

The School of Engineering at Oakland University was founded in 1965 and a General Engineering program was established with an emphasis on Systems Engineering, a broad core curriculum, and laboratories associated with every engineering course. This general engineering program was accredited in 1969. In 1978 separate majors in computer, electrical, mechanical, and systems engineering were created and received ABET accreditation. Because of the large number of computer science course offerings, and the relevance of computers both to and within the engineering disciplines, the name of the school was changed to the School of Engineering and Computer Science (SECS) in 1982.

In 1984, the non-departmental structure of the School was changed by forming three departments, one of which was Mechanical Engineering. There are now 4 departments within the School: Mechanical Engineering (ME), Electrical and Computer Engineering (ECE), Industrial and Systems Engineering (ISE) and Computer Science and Engineering (CSE).

The ME department currently offers a Bachelor of Science in Engineering with a major in Mechanical Engineering and administers a Bachelor of Science program in Engineering Chemistry, jointly with the College of Arts and Science. The ME department also offers Master's and Ph.D. degrees in Mechanical Engineering and participates in a Ph.D. program in Systems Engineering that serves as an 'umbrella' program to SECS.

In 2013-2014, the undergraduate enrollment within the department was 376 (F13) and 352 (W14) students. This does not include undecided students. Graduate enrollment consisted of 118 (F13) and 107 (W14) (pro-rated) M. S. students and 50 (F13) and 44 (W14) (pro-rated) Ph.D. students. The department includes 16 full-time faculty, 6 adjunct and a few part-time faculty. The departmental faculty are assisted by one full-time secretary, the school's technical staff, about nine graduate teaching assistants, a number of research assistants and a few post-doctoral scholars.

The mechanical engineering curriculum underwent a general ABET review during the Fall of 2008. Just prior to that review, as an outcome of prior ABET reviews and of our continuous curricular improvement process, two significant changes were incorporated in all SECS engineering programs:

- *Changes in the Engineering Core Curriculum:* As a part of our continuous curricular improvement process, a new 6-course, 21-credit engineering core curriculum (replacing the set of 28 credits previously taken by all engineering students) was implemented. The purpose of this new core curriculum was to provide all engineering students with an enhanced opportunity to:

- be exposed to a broad view of engineering early in the curriculum,
- acquire the fundamentals of computer, electrical, mechanical, industrial and systems engineering,
- develop their problem solving skills,
- develop their laboratory skills,
- use modern engineering tools early in the curriculum,
- develop their oral and written communication skills,
- participate in the design process through a significant team design experience during the sophomore year.
- improve the timely math preparedness of students as they advance through their program of study

One of the key features of this new core was a multidisciplinary 4-credit course taught jointly by ME and ECE faculty, EGR 280: *Design and Analysis of Electromechanical Systems*, which introduces material on statics, dynamics, microcontrollers and ethics and culminates in a multidisciplinary sophomore design experience. Also noteworthy was the introduction of a new 1-credit *Engineering Graphics and CAD* course at the freshman level as part of this common core curriculum.

- *Changes in the senior design course*: Prior to the 2008 ABET review, the capstone senior design course, which had been offered separately by each of the departments, was combined into a single course in which the students work in multidisciplinary teams that originally were made up of electrical engineering, computer engineering, mechanical engineering, and computer science students. Faculty members from each of the participating departments supervise the course jointly. Participating in the course now are the ME, ECE and ISE departments.

Although the ME program is mature and well developed, we have made a number of significant changes to the Mechanical Engineering program since the last review, including:

- In August 2014, the school will move into the new Engineering Center (EC), a 125,000-square-foot facility that features state-of-the-art classrooms, educational and research space, including dedicated space and prototyping/manufacturing facilities to support multidisciplinary teamwork and design in the sophomore and senior design courses. The new building will serve as the heart of the Engineering and Computer Science community at Oakland University. This will be discussed in more detail in *Criterion 4.B.*
- *Revision of our Program Educational Objectives (PEO's)* – In response to ABET's revision of the definition of PEO's to include "what graduates are expected to attain within a few years of graduation," as well as to the trend by many peer universities toward simplification and focus in the list of PEO's, the Department revised its PEO's. This will be discussed in more detail in *Criterion 2.E.*
- *Review of the Engineering Core Curriculum* - Now that the core has been in place for a sufficient period of time to allow about three freshmen classes to move through the program, each of the departments has been evaluating the effect of the new core on its curriculum and a review of the core began in the fall of 2012. An *ad hoc* committee was formed to review the core, comparing it to other universities and to also assess student

and faculty satisfaction with the core. Also, the UGCC conducted a core climate survey of the faculty. The DUACs and the UGCC have begun to review those results and to begin discussions of how to improve the core so that it satisfies the needs of the diverse departments within the course-credit limits of each of the programs. Many course-level changes have already been implemented, notably in EGR 240, EGR 250 and EGR 280. This will be discussed in more detail in *Criterion 4.B.*

- *New Nuclear Engineering Option in Mechanical Engineering* - Initially prompted by discussions with members of the SECS and the ME Advisory Boards, the ME Department developed and now offers an option in Nuclear Engineering within the Mechanical Engineering Program. This is not a Nuclear Engineering degree, but rather an option that, along with the broader mechanical engineering curriculum, will give the necessary specialization for a career in the nuclear engineering field. This will be discussed in more detail in *Criterion 4.B.*
- *Addition of a Required Engineering Ethics Course* – Prompted by external review of Key Courses, Student Course Evaluations and faculty End-of-Course Summaries, and based on discussions at the department, school and university levels, a new course, PHL 104, *Introduction to Ethics in Science and Engineering,* was developed and instituted as a new requirement for all SECS students beginning in Fall 2014 to strengthen primarily Student Outcomes *c, f, h, j*. This will be discussed in more detail in *Criterion 4.B.*
  Changes in the senior design course: To satisfy the needs of the three participating departments, the course has undergone a number a revisions since the last review, including more emphasis on formal analysis and modeling in each of the ME, ECE and ISE disciplines, and on the less technical portions (mainly demonstrating an understanding of professional and ethical responsibility, the impact of engineering solutions in a societal context, and knowledge of contemporary issues). This will be discussed in more detail in *Criterion 4.B.*

These and some of the other changes that resulted from our assessment process will be discussed in more detail in *Criterion 4.B.*

C. Options

The Department of Mechanical Engineering (ME) offers a Bachelor of Science in Engineering with a major in Mechanical Engineering, a Master of Science in Mechanical Engineering, a Ph.D. in Mechanical Engineering and participates in a Ph.D. in Systems Engineering that serves as an 'umbrella' program to the School of Engineering and Computer Science (SECS). The Department also offers, jointly with the College of Arts and Sciences, a Bachelor of Science with a major in Engineering Chemistry.

All undergraduate ME students follow essentially the same curriculum with the exception of their professional electives and general education courses. Mechanical engineering students must complete at least three additional 400- or 500-level courses with an ME designation or other approved 400-level engineering courses with an ECE or ISE designation. Students are encouraged to consult their academic advisers in selecting professional elective courses.

For the Bachelor of Science in Engineering program, students interested in broadening their knowledge in a specific area of mechanical engineering can elect sequences of courses in five different professional options to satisfy the mechanical engineering electives requirement. These options are: Energy, Fluid and Thermal Systems, Computer-aided Design, Automotive Engineering, Manufacturing Engineering, Plastics and Composites Manufacturing Engineering, and Nuclear Engineering.

Organizational Structure
The ME Department is one of four departments in the School of Engineering and Computer Science (SECS). A single department chair and one clerical assistant serve the department (see Figure D.2 in Appendix D for an organizational chart of the SECS). The chair is advised by the departmental faculty, a departmental Industrial Advisory Board and informally by student organizations such as ASME, SAE, SME and Tau Beta Pi. The department chair meets at least once per semester with the ME Advisory Board, and meets regularly with the ME Undergraduate Affairs Committee (MEUAC). The chair also meets regularly with the dean, associate dean and other department chairs within the SECS.

Faculty within the department are informally organized into groups according to whether they primarily teach in the solid mechanics area, the fluid and thermal sciences area, or the manufacturing engineering area. The informal faculty groups work together to develop teaching assignments, course objectives, undergraduate laboratory needs and other curricular matters. The MEUAC is the formal body for all departmental, undergraduate curriculum matters. The department must approve all mechanical engineering curriculum changes, proposed by the MEUAC. The chair of the MEUAC also serves as a representative in the SECS Undergraduate Curriculum Committee. Any curriculum change that involves a change to the *Undergraduate Catalog* must be brought through the SECS Undergraduate Curriculum Committee to the SECS Faculty Assembly for approval. Changes to the *Undergraduate Catalog* require a majority vote by the assembly.

D. Program Delivery Modes

Most SECS undergraduate students follow a traditional program of study that meets predominantly during the day and that includes courses that involve a combination of lecture and laboratory sessions. However, due to the proximity of Oakland University to the headquarters and engineering centers of the Big-Three automakers, as well as a large number of automotive suppliers in Southeastern Michigan, a large number of our students are employed full and part-time. To meet the needs of these students, most SECS courses are offered in time slots beginning at 3:30 pm and a limited number of courses are offered on Saturdays or during the summer sessions to accommodate part-time students. Also, satellite courses mostly at the junior and senior level are offered at Macomb University Center (MUC), about 17 miles from Oakland University's main Rochester campus, through a partnership with Macomb Community College (MCC).

The majority of SECS courses are offered in a traditional lecture/laboratory format. Most courses make use of online resources, some have significant online work required, and occasionally courses are offered that are entirely online. Some SECS programs simulcast courses between the main campus and the MUC, aided by teaching assistants during lectures and in-person laboratory sessions. Several of the live classes have incorporated live recording of lectures, which are then made available to enrolled students through MOODLE (our course management system). The recorded lectures allow students to review lecture material and also to make up for missed lectures due to work related conflicts such as travel.

E. Program Locations

The majority of courses are offered on Oakland University's main campus in Rochester, MI. Many SECS courses are also offered at the Macomb University Center in Clinton Township, MI, approximately 17 miles east of Oakland University's main campus. To date, the ME department has offered a number of course sections at MUC, mostly at the sophomore and junior levels.

Additionally, the SECS has articulation agreements with Beijing Jiaotong University, Beijing Information Science and Technology University and Changchun University of Technology. These articulation agreements are not programs or dual degrees, but rather agreements similar to those the university has with local community colleges.

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

No Deficiencies, Weaknesses, or Concerns remain from the most recent ABET Final Statement, dated August 12, 2009.

GENERAL CRITERIA

CRITERION 1. STUDENTS

A. Student Admissions

Candidates for admission to undergraduate degree programs should have completed high school-level college preparatory work or otherwise demonstrate sufficient academic preparation to begin college work. Normally, high school courses should include, as a minimum, four years of English language arts, three years of mathematics, three years of science, three years of social studies and two years of world language. Students planning majors in the sciences, mathematics, engineering or business are expected to present at least four years of preparation in math, including algebra, geometry and trigonometry. Consideration for admission is based upon an applicant's academic background, including high school academic achievement, educational goals and potential for success at Oakland University. Students applying as freshmen must submit scores from the American College Test (ACT) or College Board SAT.

Entering freshmen planning to major in engineering or computer science should have taken at least four years of high school mathematics courses (maintaining a 3.00 or B average) as well as courses in chemistry and physics and have a solid background in English language arts. Computer aided design and machine shop courses are useful, but not necessary. Normally, a 3.00 (B average) is required for admission to the School of Engineering and Computer Science.

B. Evaluating Student Performance

Oakland University has a numerical grading scale of 0.0 to 4.0. Each course completed at Oakland University is awarded a grade in this range in increments of 0.1. A course grade of less than 1.0 is a failing grade. Students must repeat such a course. Grades below a 2.0 are considered sub-standard. The minimum cumulative grade point average for graduation is 2.00. In addition, satisfactory completion of the program requires an average grade of at least 2.00 within each group: namely, mathematics and science, core subjects, and professional subjects. Within professional subjects, at most two grades below 2.0 are permitted; at most three different courses may be repeated and a total of three repeat attempts are permitted.

The average course grade for engineering students at Oakland varies from approximately, mid 2.0's to low 3.0's from the freshman-level to senior-level courses. Students achieving a cumulative grade point average of 3.5 and above in the courses offered by the School of Engineering and Computer Science are awarded Departmental Honors. The University Honors are awarded on the basis of cumulative grade point average:

- 3.6 – 3.74 Cum Laude,
- 3.75 – 3.89 Magna Cum Laude,
- 3.90 – 4.0 Summa Cum Laude.

A student's progress toward meeting the degree requirements is recorded and monitored regularly. Each student's transcript is available online through the University's 'Banner' system. Complete student files are maintained in the Undergraduate Advising Office.

Prerequisites are automatically checked by the Banner system when a student attempts to register for a course. Registration is not allowed if the student does not have the proper prerequisites. In rare circumstances a faculty member or advisor may waive the prerequisites for a particular student in a course and allow registration to proceed. A waiver form is required and must be approved by the teaching faculty and the Chair of the department. A prerequisite check list is sent to the advising office at the end of the semester from the Registrar's Office showing students who have not met the prerequisite (by course completion or waiver) for the upcoming semester. Students on this list are removed from the course if they have not met the prerequisite.

Previously, at the end of each semester, the SECS Advising Office would make note of students who received any grades less than 2.0 and/or failed to meet other performance requirements. A letter warning them of the consequences of sub-standard performance was sent to each such student. Students were then advised to meet with an SECS Advisor and take corrective measures. In Fall of 2014, the SECS will begin using a new analytic software package, *Student Success Collaborative*, to work with students who may be struggling in the major. SECS will be one of the pilot programs and will be looking at students from 3 categories – red (alert), yellow (borderline), and green (successful). Academic advisers will be reaching out to students in the red and yellow categories starting in the fall to provide more intensive advising.

Students who are not in compliance with the performance requirements are placed on academic probation for at least one semester. Students who fail to meet the minimal standard of progress established by the University Senate are dismissed from the University.

Students having academic difficulty are advised to get help from the Tutoring Center, located in North Foundation Hall. The Tutoring Center provides tutoring sessions for a number of courses. The Engineering Honors Society, Tau Beta Pi, also provides tutoring sessions for some engineering courses. Students are also directed to attend such sessions.

C. Transfer Students and Transfer Courses

Transfer students with a minimum of 24 college credits at the time of application and a GPA of at least 2.5 will be considered for admission to Oakland University. OU also will consider positive trends of most recent grades. Transfer students with fewer than 24 college credits at the time of application also must submit a high school transcript. Admission will be based on both college and high school records.

To be considered for transfer admission, students must submit an online application and send official transcripts of course work taken at all universities or colleges attended to Oakland University. While some students may be admitted based on unofficial documents, this does not remove the obligation to provide official transcripts. Students who fail to provide official transcripts will be prevented from registering in subsequent semesters until all transcripts have been received. Students who have attended more than one college should submit official transcripts from each institution.

D. Advising and Career Guidance

The role and mission of faculty and professional academic advising at Oakland University is to advise students as they seek to develop academic, career and life goals and establish plans to accomplish these goals. This is a continuous process of discovery, clarification, and evaluation, whereby advisers assist students in identifying possibilities, assessing alternatives, and weighing the consequences of decisions.

Full-time professional academic advisers are available to students in each of the schools, the College of Arts and Sciences, the Bachelor of Integrative Studies office and the First Year Advising Center (formerly Advising Resource Center). Faculty advisers are also available in many majors. For assistance in understanding program admission requirements and enrollment limitations, as well as university and degree requirements, students consult with professional advisers and/or faculty advisers. While students receive initial advising assistance in orientation, they are encouraged to seek individual assistance as early in their programs as possible and to see their advisers regularly thereafter. Most advisers see students for individual appointments arranged at their mutual convenience. Students must file a written program plan. Advisers can help students complete such plans as well as verify that all degree requirements are being met in a timely fashion.

Students who enter OU as freshmen are advised in their first year by the OU First Year Advising staff. At the end of the first year at OU (regardless of how many credits have been taken at that point), or earlier for high-achieving students, students are released to the SECS for advising through graduation. Students are required to meet with the professional advisers at least once per year, though most seek advice at least once per semester. The professional advising staff refers students to faculty mentors for advice on career choices, professional course electives, research opportunities and other professional issues as needed.

A significant number of our students work full- or part-time or undertake internships in local companies. Students receive emails directly from the OU Career Services whenever internships, co-op opportunities or job posting become available. Interviews for these opportunities are scheduled directly through the Office of Career Services. Two career fairs are organized for SECS students each year, a large Engineering and IT Fair in late September and a smaller fair in January. Throughout the year local companies come on campus to meet students (for example, the *Coffee with Chrysler* program) and occasionally invite students to visit their locations. The Office of Career Services conducts mock interviews and offers resume workshops on a regular schedule, and meets with the students in the Engineering Core courses.

E. Work in Lieu of Courses

Students may receive credit toward graduation designated as competency credit (graded S/U) on their transcripts for Oakland University courses, subject to the following provisions:

1. That they register for the course at registration with written permission of the departmental chairperson, dean or program director of the academic unit responsible for the course.
2. That they pass an appropriate competency examination not more than six weeks after the term begins. Competency credit will not be permitted for a course when a student has received credit for more advanced courses in the same area.
3. The repeat course rule applies to the repeating of competency examinations (see Repeating courses).
4. That they pay the appropriate charges.

Students may apply up to 60 credits based on non-classroom experience (course competency, Advanced Placement, IB and/or CLEP credits) toward a degree program. Students seeking second degrees are limited to 16 credits of non-classroom experience. Students may not apply non-classroom experience (course competency, Advanced Placement, IB and/or CLEP credits) to satisfy General Education requirements for Writing Intensive in General Education or Writing Intensive in the Major.

F. Graduation Requirements

Students may graduate at the end of any semester during the academic year. The graduation requirements are specified in the undergraduate catalog under each program listing. Based on these requirements, the Advising Office of the School of Engineering and Computer Science reviews the form entitled *Plan of Study* (Exhibit E.1). Students are introduced to the Plan of Study at freshman orientation. At the end of the freshman year, OU First Year Advising releases the students to the SECS, and the initial SECS Plan of Study is completed at that time. The Plan of Study is updated as the student progresses through his/her program. In the semester preceding the one that the student is planning to graduate, he/she submits a Graduation Review form (Exhibit E.2). The information given on this form and on the Plan of Study becomes the basis for a check on the students meeting the graduation requirements. The University's Registrar Records Office carries out further checks on the graduation requirements. An Advanced Standing Report from the office is sent to the student's academic unit. The details provided by the Registrar are compared to the Graduation Review conducted by the SECS Advising Office. This provides a cross check and prevents any errors in the process.

Any exceptions or substitutions to the published degree requirements must have prior approval of the SECS Committee on Academic Standing. The committee carefully reviews each petition before rendering its decision. If a course is presented for transfer from another institution, the course content, syllabus, assignments, and other details are forwarded to a faculty member teaching the course. The committee takes the faculty member's recommendations into account before making a decision. If students take classes as guest students at other institutions, they are required to submit a Transfer Course Request to the Undergraduate Advising Office for approval.

G. Transcripts of Recent Graduates

The Program name, college and major are stated on the official OU transcript. A sample 'snapshot' taken from the online version is shown below. Copies of official transcripts have been sent to ABET with the request for this review.

Curriculum Information	
Primary Degree	
Program:	BSE Engineering
College:	School of Egr. and Comp. Sci.
Major:	Mechanical Engineering

Figure 1.1 Program Designation from Sample Online Transcript

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

A. Mission Statement

The following role and mission statement for the university was adopted by the Oakland University Board of Trustees on July 21, 1982, and amended by the Board of Trustees on March 28, 2012. It emphasizes four essential ingredients for the direction of the university: excellent and relevant instruction; high-quality basic and applied research and scholarship; responsive and effective public and community service; and a comprehensive schedule of student development activities.

> *As a state-supported institution of higher education, Oakland University has a three-fold mission. It offers instructional programs of high quality that lead to degrees at the baccalaureate, master's and doctoral levels, as well as programs in continuing education; it advances knowledge and promotes the arts through research, scholarship, and creative activity; and it renders significant public service. In all its activities, the university strives to exemplify educational leadership in a diverse and inclusive environment.*

The SECS mission statement, found in the OU Undergraduate Catalog, as well as on the SECS website, echoes the three-fold mission of teaching, research and service, applies them to engineering and computer science, and then focuses them to the specific, and highly relevant, automotive and automotive-related industries of our constituents:

The overall mission of the School of Engineering and Computer Science is threefold:

- *to provide high-quality undergraduate and graduate programs of instruction in engineering and computer science to prepare graduates for careers in the coming decades,*
- *to advance knowledge through basic and applied research in relevant branches of engineering and computer science, and,*
- *to provide service to both the engineering profession and the public of the State of Michigan.*

In carrying out its mission the School will address the needs of the automotive and related industries in southeast Michigan for the:

- *education of engineers and computer scientists,*
- *development of research programs and*
- *fulfillment of the demands for professional service.*

This mission statement was developed by the SECS faculty and the SECS Advisory Board and was adopted by the SECS Faculty Assembly. It is reviewed periodically by each of these groups.

The **mission statements** of the SECS departments, found in the OU Undergraduate Catalog, as well as on the SECS website, state that each department carries out the mission of the School by offering relevant programs in their respective engineering disciplines. The mission statement of the Mechanical Engineering Department states:

> *The* ***Department of Mechanical Engineering*** *carries out the mission of the School of Engineering and Computer Science by offering undergraduate majors in mechanical engineering including various options. The department also offers a master's program in mechanical engineering and a Ph.D. in mechanical engineering.*

B. Program Educational Objectives

The program educational objectives (PEO's) of the Mechanical Engineering Department can be found in the OU Undergraduate Catalog, as well as on the SECS website.

The objectives of the Mechanical Engineering program are to produce graduates who:

- *have the* ***technical knowledge and skills*** *necessary to function effectively in an engineering role within the automotive and other global industries,*
- *are cognizant of the need for* ***lifelong learning*** *and are prepared to pursue successfully graduate study in mechanical engineering or other post-graduate education, and*
- *have an awareness of* ***ethical responsibility****, and have the* ***communication****, problem-solving and* ***teamwork*** *skills necessary to function effectively in the modern multidisciplinary workplace.*

This set of PEO's was significantly revised in 2013-2014.

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

The program educational objectives are consistent with the three-fold mission of teaching, research and service of Oakland University, particularly as they apply to the modern practice of engineering in the automotive and other global industries.

D. Program Constituencies

The constituent groups of the Mechanical Engineering Department consist of the faculty, students and alumni of the School of Engineering and Computer Science, its School and Departmental Advisory Boards and employers in Southeast Michigan, particularly those related to the automotive industry. The ME department has a Mechanical Engineering Advisory Board, the main mission of which is to assist the department in enhancing its educational and research programs as well as ensure their relevance to current and emerging technological needs. The nine board members are affiliated with local industries, including GKN Driveline, TARDEC, Chrysler Group, LLC, Detroit Edison, Ford Motor Company, Wayne State University and

General Motors Corporation. The Board meets at least annually and regularly reviews the PEO's and the entire program with the department chair. Alumni are surveyed and asked to self-assess how well they met the PEO's, and also asked for suggested changes to the PEO's. Also, key employers are asked to evaluate our students, in comparison to students from other institutions, and also to review our PEO's for relevance to their needs.

E. Process for Review of the Program Educational Objectives

All of the SECS departments have an active Advisory Board, consisting of local industry leaders who volunteer to provide insight to industry needs and foster SECS/industry relationships. These groups regularly review and discuss the appropriateness of the PEO's with respect to both the OU/SECS missions and the needs of industry. In addition, SECS alumni are surveyed periodically for input. These surveys always include questions on the applicability of the program's PEO's. In addition to the Advisory Board, alumni and key employers are also surveyed about the appropriateness of our PEO's and about how well OU alumni achieve the PEO's.

Achievement of Program Educational Objectives
Feedback on the relevance and completeness of the PEO's and their achievement, as evidenced by the performance of OU alumni in the workplace, are the main focus of the Alumni Survey and regularly scheduled meetings with Advisory Board members and other local employers.

The SECS alumni have been surveyed since 2004 (see Exhibit E.3 in Appendix E for a sample form). Often in the past, few of these surveys were returned, partly due to a lack of up-to-date contact information and partly due to time required and the volume of email that most working people receive. The online survey was revised in 2013 and a student was hired to send personalized emails to alumni (for whom we had contact information) and to send reminders to those alumni. In 2013, over 200 alumni were contacted and 58 surveys were returned.

The current PEO's were derived, in part, from the previous set of PEO's, and since the current PEO's were not yet officially approved yet by the faculty assembly at the time that the alumni survey was conducted, the 2013 survey queried alumni about the **previous** set of PEO's, which read as follows:

The (previous set of) objectives of the Mechanical Engineering program were to produce graduates who:

- *analyze, design, develop and/or test components or systems in the areas of mechanics and/or fluid and thermal sciences;*
- *use laboratory (instrumentation, testing, prototyping, etc.) and/or computer skills for engineering analysis and design;*
- *adapt and contribute to new technologies and methods, and use these in engineering design;*
- *if desired, pursue successfully graduate study in mechanical engineering or related disciplines;*
- *function successfully in local, national or global technology-driven industries;*

- *exhibit the willingness and flexibility to seek, accept and be effective in a variety of roles, such as developing and implementing solutions to problems with technical and non-technical elements, serving as a team member and leading others;*
- *communicate effectively in both written and verbal forms; exhibit high standards of personal and professional integrity and ethical responsibility*

A histogram of the ratings of the Program Educational Objectives for all SECS alumni responses received in 2013 are shown below in Figure 2.1:

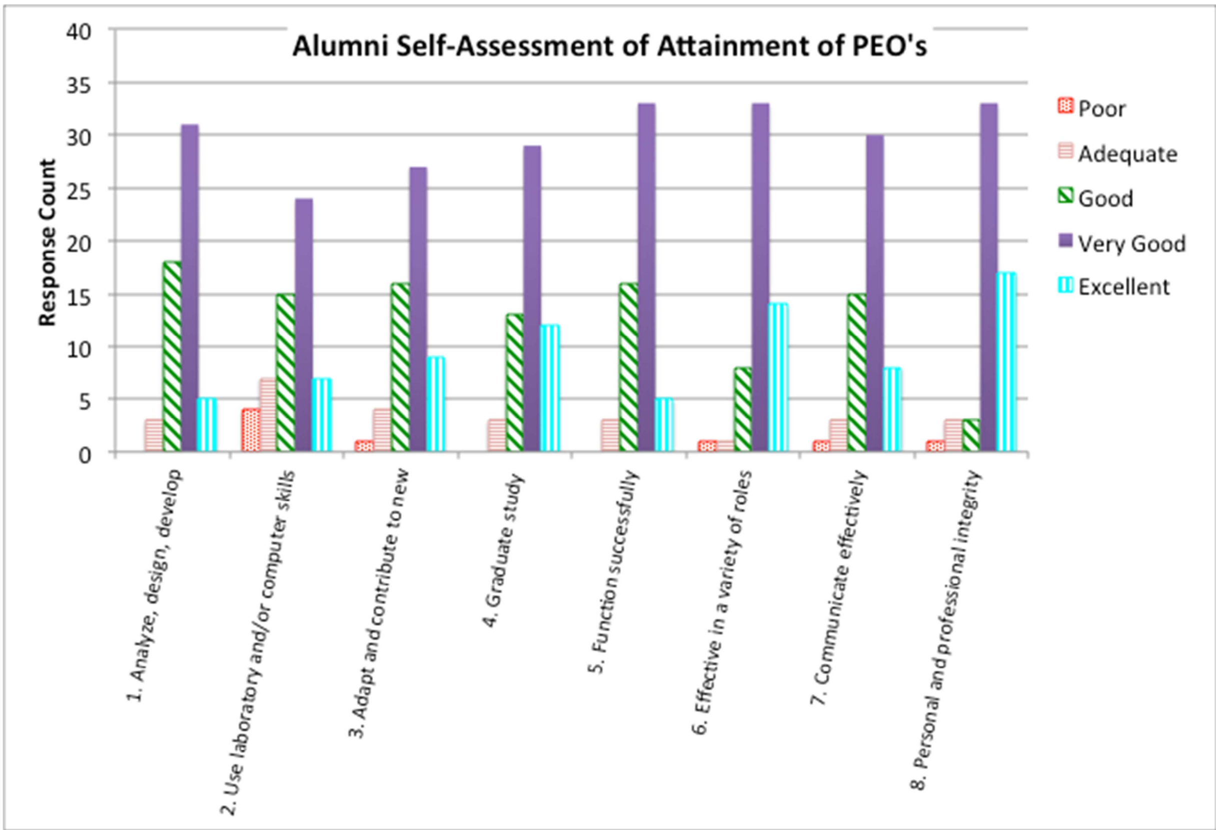

Figure 2.1 PEO Assessment Results based on Alumni Surveys

Another view of the data is given in Table 2-1, below in which the percentage of response in the categories *Very Good to Excellent* and *Good to Excellent*, are shown.

Table 2-1 PEO Assessment Results based on Alumni Surveys

PEO's	Percent Very Good to Excellent	Percent Good to Excellent
1. Analyze, design, develop…	63.2	94.7
2. Use laboratory and/or computer skills…	54.4	80.7
3. Adapt and contribute to new technologies…	63.2	91.2
4. Graduate study…	71.9	94.7
5. Function successfully…	66.7	94.7
6. Effective in a variety of roles…	82.5	96.5
7. Communicate effectively…	66.7	93.0
8. Personal and professional integrity…	87.7	93.0

As seen from the survey results, the alumni rate their own accomplishment of the PEO's very highly, with possibly the exception of the second PEO. This was surprising, since the ME program is very laboratory-intensive in comparison to most other ME programs. One alumnus even commented that "I feel confident in my ability to work in a lab with experimental equipment for 2 reasons: 1-because of the extensive lab components associated with most engineering classes, 2-because of my independent study research conducted to meet the ME 490 requirement." Another former student said that his/her "Laboratory preparation was very good." Also, several employers have been asked to rate OU grads, especially compared to graduates of other institutions, using a scale of *Good*, *Fair*, or *Poor*. Employers consistently rate OU grads as *Good* (highest score) in technical skills. The very limited number of negative remarks in the commentary by alumni, following this objective, were related to the use of some aging equipment, and this may explain the discrepancy between employers and most of the students who rated the second PEO *Very Good to Excellent*. With the move to the new 125,000 sq-ft Engineering Center, scheduled for Fall 2014, students will have acess to newer and more extensive laboratory equipment. We will monitor this topic as the current PEO's are assessed in future surveys.

Alumni comments about the PEO's have been generally very positive. Some of the suggestions for improvements relate to a perceived need for practical training and occasionally business skills. Some sample comments are given below:

- "It is very good for people seeking a career in research but is lacking badly in teaching business skills which most engineers need. Specifically project management and money. More statistics and design theory would also be good. "

- “Overall, it was a very good program. I felt comfortable moving into the engineering field after graduation. My general critical thinking / problem solving skills were definitely above average but I did lack in part design concepts and component tooling.”
- “I found that the majority of the math/calculus courses are far above and beyond what I would use in real-world situations. Any complicated mathematics needed is almost exclusively done by computers.”
- “Need Machining courses and more design courses”
- “I thought the professors were excellent. The work was hard but rewarding. I am proud to be an OU grad.”

Employers of SECS graduates were also surveyed online for several years for their input on the achievement of the Program Educational Objectives, unfortunately with response rates that were very low. In talking with peers at other institutions, it appears that this is a common problem. In order to gather more of this important data, it was decided in 2005 to replace the online employer surveys with face-to-face meetings, which may occasionally be supplemented with online surveys. These meetings were either scheduled expressly to discuss the performance of SECS alumni or as part of research or other business meetings. Advisory Board members and employer groups are always notified in advance that the performance of OU alumni will be discussed so that relevant data can be collected and be available for reference. These face-to-face discussions center on how well OU graduates meet the expectations of the PEO’s and whether revisions ought to be made to the PEO’s themselves or the education programs in order to improve the performance of alumni in professional practice.

This method of face-to-face discussion and feedback has been very well received, and has proven much more valuable and complete than the older online employer surveys. These meetings are always lively and provide good insight as to the needs of employers. To date, every employer questioned has been pleased with OU alumni achievement of the previous set of PEO’s, and no revisions to the PEO’s have been suggested by employers. Discussions of the skills for modern engineering practice, however, have led to many specific suggestions for program improvements, and have expressed enthusiasm for the ongoing changes to the Senior Design Experience (see Section 4.B.). Some recent comments from the employer meetings are listed below:

- “Need to prepare UG's in practical knowledge and experience related to automotive engineering by offering some practical classes/seminars in Body, Chassis, Suspension in their senior year with Chrysler Experts.”
- “Encourage ME students to get involved with SAE.”
- “Involve local experts in Senior Design.”
- “Areas of study could be strengthened include: DFSS, DOE, Optimization, Reliability, etc.”
- “They (OU grads) are very competent in their areas of specialization and quickly able to learn new areas.”
- “Continue to add more focus on Formal Presentation Skills and Critical Analysis of Problems”

The ME Department recently revised its PEO’s. The previous set of PEO’s was drafted and revised through extensive consultation with the School and Department Advisory Boards and other industrial partners, and was put into place in early 2002. Alumni (through online surveys), Advisory Board members (at least annually during regularly scheduled meetings), and other local employers (at research or other business meetings) are regularly asked to review the set of PEO’s for relevance and completeness, and all constituencies have been satisfied with the previous set of PEO’s.

However, in response to ABET’s revision of the definition of PEO’s to include "what graduates are expected to attain within a few years of graduation," as well as to the trend by many peer universities toward simplification and focus in the list of PEO’s, the Department began discussions to revise the PEO’s. Again, although the constituencies were relatively satisfied with our PEO’s, the original list of PEO’s was too similar to the list of Student Outcomes (formerly Program Outcomes). That is, the PEO’s were more like a specific skill set, rather than a broader set of characteristics of the program’s graduates. A preliminary set of revised PEO’s was developed by the Department and then discussed with the Advisory Board and local employers, where further revisions were made. The new set of PEO’s was further refined by the Department to meet the recommendations of the Advisory Board and the SECS assembly, and then finally approved by the SECS assembly in Winter of 2014.

The revised (current) set of **Program Educational Objectives** for the Mechanical Engineering Department are to produce graduates who:

1. *have the **technical knowledge and skills** necessary to function effectively in an engineering role within the automotive and other global industries,*
2. *are cognizant of the need for **lifelong learning** and are prepared to pursue successfully graduate study in mechanical engineering or other post-graduate education, and*
3. *have an awareness of **ethical responsibility,** and have the **communication**, problem-solving and **teamwork** skills necessary to function effectively in the modern multidisciplinary workplace.*

As can be seen in the Table 2-2, below, the original PEO’s could be grouped into three broad categories. The new PEO’s were written to address these broad categories and encompass the spirit and content of the original set of PEO’s, thereby satisfying the constituencies and ensuring that the PEO’s are consistent with the institutional mission. The ME Advisory Board was instrumental in the development of the new PEO’s and some employers were surveyed to assess their satisfaction with the PEO’s as well as how well our graduates attain these within a few years of graduation.

Table 2-2 Relationship of Revised PEO's to Original PEO's

Original PEO's	Fundamental Characteristics	Revised PEO's
are able to analyze, design, develop and test components and systems in the areas of mechanics and fluid and thermal sciences; can adapt and contribute to new technologies and methods and to use them in engineering applications; can function successfully in the automotive and other global industries;	Basic **technical** skills necessary to function effectively in an engineering role	*have the **technical knowledge and skills** necessary to function effectively in an engineering role within the automotive and other global industries,*
are prepared to pursue successfully graduate study in mechanical/manufacturing engineering or other advanced post-graduate education;	Graduate study/continuing education/lifelong learning	*are cognizant of the need for **lifelong learning** and are prepared to pursue successfully graduate study in mechanical engineering or other post-graduate education,*
are proficient in written and oral communication; can serve in a variety of roles within or leading a team solving problems with technical and non-technical elements; and have high standards of professional integrity and ethical responsibility.	More advanced 'soft skills', such as Communication skills, Team Skills and Ethics	*have an awareness of **ethical responsibility**, and have the **communication**, problem-solving and **teamwork** skills necessary to function effectively in the modern multidisciplinary workplace*

While the new PEO's have only been in place officially for a few months, the department decided to conduct a preliminary assessment from key employers about the new PEO's and about the distinctive features of our undergraduate Mechanical Engineering programs, namely the interdisciplinary core curriculum, and the emphasis on laboratory experience including teamwork. In earlier assessments, the laboratory and/or computers skills were rated lower than expected by alumni, and so it was thought that this assessment might help to clear up the discrepancy. An online survey (Exhibit E.9) was conducted in the Winter 2014 semester. About 28 specific Senior Recruiters and HR staff were targeted, but only 5 responses were received. As can be seen in Figure 2.2, employers (albeit a small sample) rated OU alumni highly in comparison to graduates from other universities.

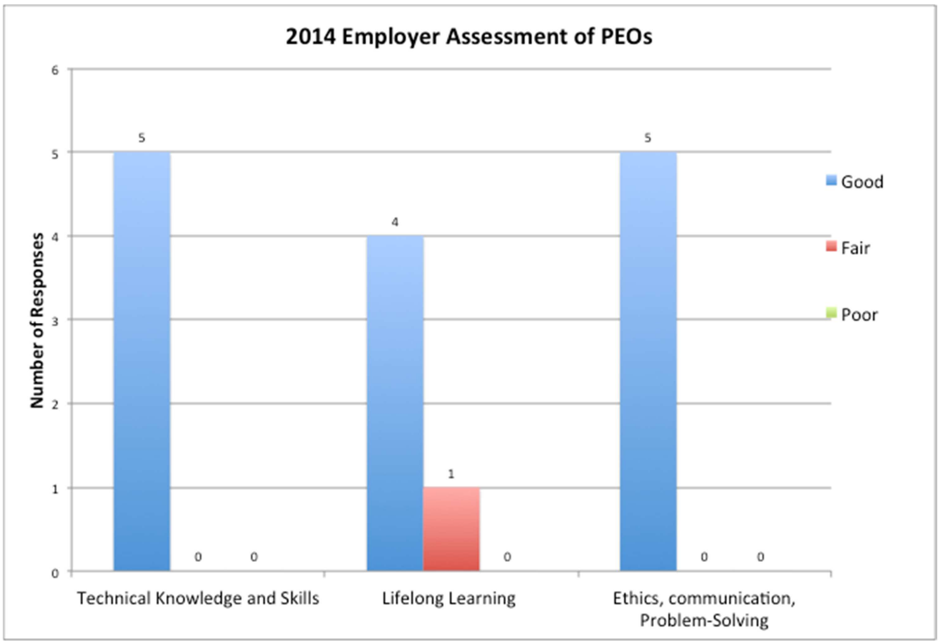

Figure 2.2 2014 Employer Assessment of PEO's

In addition, the employers provided the following comments:

- "OU does an excellent job preparing students for the basic fundamentals. I encourage the ME department to stay the course and resist the desire to chase fads in the industry. Let the employers provide the specialized training needs for specialties."
- "Keep focusing on lab related classes. That is where the real learning occurs."
- One employer suggests that OU grads should have "SAP experience and AutoCAD."

The department will continue the interaction with the Advisory Board and employers and will continuously evaluate their suggestions for possible implementation within the curriculum.

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes

The Student Outcomes of the Mechanical Engineering program are:

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
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
d. an ability to function on multi-disciplinary 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.

B. Relationship of Student Outcomes to Program Educational Objectives

The relationships between Program Educational Objectives and Student Outcomes are shown in Table 3-1. Each Educational Objective is addressed by several Student Outcomes. Therefore, achievement of Student Outcomes will naturally lead to achievement of the Program Educational Objectives. The Mechanical Engineering Undergraduate Curriculum Committee (MEUAC), along with the department chair, are responsible for monitoring these Student Outcomes and ensuring that the curriculum will guarantee that graduates achieve the Student Outcomes.

Table 3-1 - Relationship Between Student Outcomes and Program Educational Objectives

Program Educational Objectives	**Program Outcomes**										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
1. *Have the **technical knowledge and skills** necessary to function effectively in an engineering role within the automotive and other global industries,*	X	X	X	X	X		X	X	X	X	X
2. *are cognizant of the need for **lifelong learning** and are prepared to pursue successfully graduate study in mechanical engineering or other post-graduate education*	X							X	X	X	X
3. *have an awareness of **ethical responsibility**, and have the **communication**, problem-solving and **teamwork** skills necessary to function effectively in the modern multidisciplinary workplace*		X	X	X		X	X	X			

CRITERION 4. CONTINUOUS IMPROVEMENT

A. *Student Outcomes*

SECS Program Assessment Overview

The SECS faculty has always been committed to continuously improve the quality of both the SECS undergraduate and graduate educational programs. The faculty has developed and implemented a systematic, formal plan to measure, assess, evaluate and improve the SECS programs. The development of this plan began with identifying and reaching out to the constituent groups the SECS serves: our students, employers and faculty. Representatives of the constituent groups determined educational objectives for each program that describe the goals necessary for successful modern engineering practice. Outcomes were also identified for each educational program that ensure demonstration of the student skills necessary to achieve the educational objective goals in professional practice.

Assessment question: *Do SECS students demonstrate achievement of the student outcomes before graduation?* Student outcomes are a set of skills necessary for successful professional practice, and include problem solving, laboratories, design, teamwork, ethics, interpreting data, communication, information literacy, contemporary issues and modern engineering tools.

The SECS program assessment/improvement process involves both indirect and direct measures of the success of each course within each program as well as overall measures of the educational programs and of the assessment process itself. In order to make efficient use of resources, the assessment and continuous improvement process is implemented School-wide. Each component of the assessment process is described briefly below.

Program Evaluation. The overall success of a program is measured by whether the students of that program can demonstrate achievement of all outcomes before they graduate, and if the professional objectives of the program are demonstrated as the students are professionally employed. Key courses are identified in each program where students have multiple opportunities to demonstrate achievement of the student outcomes. The set of key courses is chosen to insure that all of the student outcomes are demonstrated. Student materials that may provide evidence that the outcomes have been achieved are collected from the key courses. External evaluators, including but not limited to faculty not directly involved with the course and departmental advisory board members, review these materials to establish whether the students in that class have demonstrated some or all of the student outcomes and the level to which those outcomes are achieved. The department undergraduate affairs committees (DUAC) review the results of these external evaluations and, when necessary, generate appropriate plans to improve the achievement of the student outcomes.

Course Evaluation. Each SECS course has a set of course objectives, developed by the instructing faculty and department undergraduate affairs committees (DUACs), which insure the logical sequence of topics throughout the program that are necessary to the eventual, successful achievement of the student outcomes. At the end of each semester, the students and faculty in each course rate how well the objectives in each particular course section were achieved. The faculty member identifies the specific program outcome(s) achieved in the course and cites student work as evidence in support of their assessment. In addition, faculty are encouraged to comment on how well the course fits into the overall scheme of the program and to suggest improvements to the course, the course objectives and the overall program of study. The department chairperson reviews these course evaluations on a regular basis and forwards the suggestions for improvement to the department undergraduate affairs committee (DUAC) for consideration, prioritization and action. Each DUAC is composed of several faculty members, and the department chair as ex-officio member.

Input of Constituents. In addition to directly measuring the demonstration of student outcomes, several other tools are utilized to gather additional information about the overall health and success of each program. Students are surveyed as they exit the SECS programs and are asked about every aspect of their OU experience, focusing on the achievement of the student outcomes. Oakland alumni are surveyed and are asked how well the SECS programs prepared them for professional employment and graduate study. Alumni are also solicited for suggestions for improvements to the programs of study and the program's objectives. Faculty assessment coordinators meet regularly with employers of our graduates and members of the SECS and departmental advisory committees, who are asked to comment on the preparation of the graduates for professional employment and are also solicited for suggestions for improvements to the programs of study and the program objectives. The information gathered with these additional tools are examined and evaluated by the department undergraduate affairs committees (DUAC), who subsequently generate plans, when necessary and based on the input, to improve the programs.

Documentation and assessment process evaluation. As indicated above, the various steps of the SECS assessment process are:

- external evaluations of student outcomes in key courses
- student end-of-course evaluations
- faculty end-of-course summaries
- chair review of evaluations and summaries
- exit surveys and input from alumni and employers
- consideration of feedback by DUAC, recommend improvements to program

The SECS assessment process is depicted graphically in Figure 4.1, below:

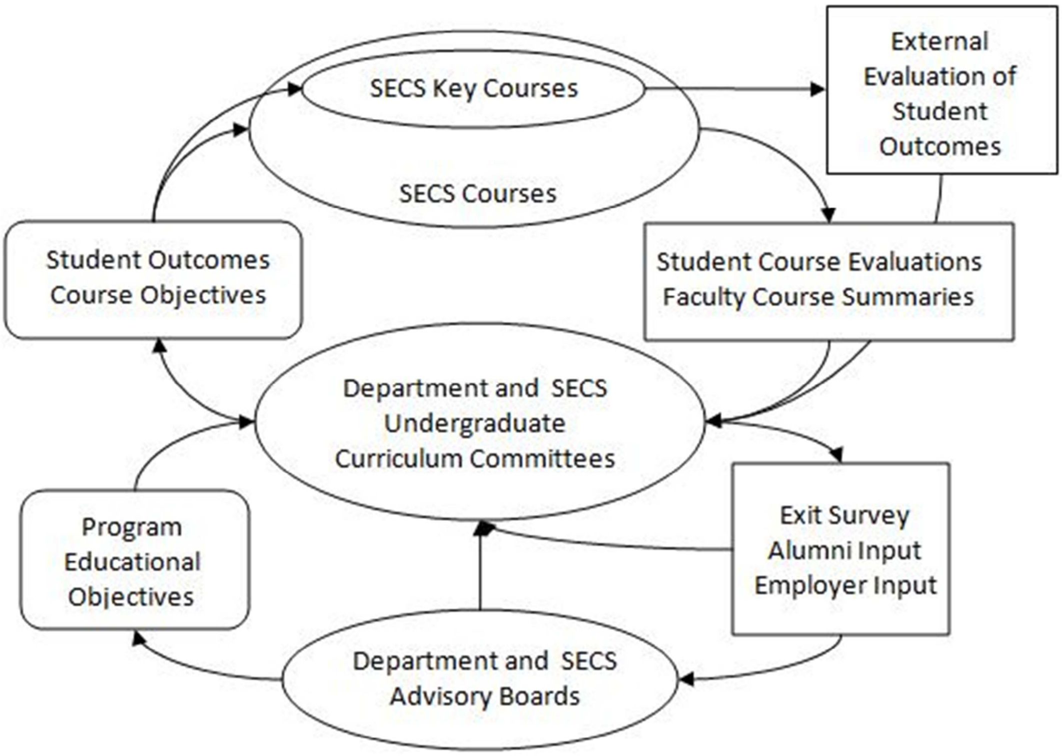

Figure 4.1 SECS Assessment Process Flow Chart

Assessment Tools

The assessment of the SECS programs relies on the external evaluation of the achievement of student outcomes in key courses, the student end-of-course evaluations and the subsequent faculty end-of-course summary as the main, most frequent and most useful measures by which the student outcomes are evaluated. Senior exit surveys are also used to assess student outcomes. Alumni surveys, employer surveys and meetings, and faculty surveys are used to gather additional information and assess the viability of the program educational objectives. Feedback from all of these assessment tools are considered, discussed and used to make curricular and programmatic changes as necessary to insure the continuing high quality of the SECS programs. The assessment tools are described below and are identified as to their importance and how they fit into the SECS assessment process. A flexible schedule of assessments events is given to illustrate the continuous process of program development and improvement.

External Assessment of Student Outcomes

In each SECS program of study, certain key courses are identified. These key courses are (1) required of all students in the program, (2) not able to be transferred from other institutions and (3) selected so that evidence of the achievement of all student outcomes is possible through the entire set of key courses. Key courses normally (with a few exceptions) reside at the top of the program curriculum and always include the program's major design experience, with the remainder chosen by the program's department undergraduate affairs committees (DUAC).

Student work is identified by the faculty in the key courses as demonstrative evidence of the achievement of the student outcomes. The student work is collected and, after the assignment of course grades, is evaluated by an impartial committee. This committee, composed of SECS faculty (excluding the course instructor) and other external volunteer reviewers, examines the students' work only for evidence of the accomplishment of the student outcomes and rates the level at which the outcomes were demonstrated, based on the evidence provided. A rating of 4 out of 5 from the evaluators is required for a program outcome to be considered achieved with the evidence provided. The results of this direct assessment of student work are used by the department undergraduate affairs committee (DUAC) to make recommendations for the further development and improvement of the program. Actions taken by the DUAC can include, but are not limited to, recommending course and/or program changes, selecting a different set of key courses, recommending that other evidence be collected and evaluated, or recommending changes to the assessment process itself.

The external evaluation of the student outcomes is a powerful tool to assess the SECS engineering programs, and is our primary metric to determine whether the student outcomes have been demonstrated. When it was first implemented, evaluators (especially non-faculty) tended to use either the very top or bottom of the scale, and evaluators expressed uncertainty as to how they were to gauge the student materials. Two steps were taken to insure consistent and accurate results. Firstly, an online evaluation form generator was developed for use by the instructors of the key courses. Instructors choose only those student outcomes that are to be evaluated with the student work from their courses, and an evaluation form is automatically generated that is specific to the student work to be assessed. (Exhibit E.4) Secondly, a standard set of instructions for the evaluators is automatically printed with the evaluation forms and serves as a brief training and reference aid for new evaluators.

Student End-Of-Course Evaluations

Each SECS course has a set of course objectives, arrived at through collaboration of the faculty who teach that course and the DUAC. The DUAC assures that the course objectives are consistent with those of prerequisite and subsequent courses and that ample opportunity exists throughout the curriculum for students to demonstrate their abilities as described in the student outcomes. Course objectives are critical to the structure of the program, are consistent across different course sections and are changed only through consultation with the DUAC.

At the end of each semester, each student in every SECS course is given the opportunity to submit an online evaluation of the course. In addition to soliciting the student's perception of the quality of the instruction and the performance of the instructor, the end-of-course evaluation also asks the student for his/her impression of how well each course objective was met, on a scale of 1 (poor) to 5 (excellent). Students are also encouraged through open-ended questions to comment on various aspects of the course. This indirect and perceptive measure of the quality of the coverage of the course objectives has correlated very well with the topics actually covered in courses, making this a reliable measure of these indices.

The End-of-Course Evaluations (Exhibit E.5), for all courses in each SECS department, are reviewed regularly by the department chair, and findings are forwarded to the DUACs for further discussion and action if necessary.

Faculty End-Of-Course Summaries

At the end of each semester, after the students submit their End-of-Course Evaluation and after the submission of final grades, each SECS faculty member is required to complete an End-of-Course Summary. The End-of-Course Summary contains two parts: instructor comments of how well the course objectives were met and specific examples of student work that could be used as evidence of the demonstration of student outcomes (Exhibit E.6).

The first part of the End-of-Course Summary allows the instructor to comment on how well the objectives of the course were fulfilled. If the students rate (via the course evaluations) the fulfillment of a particular course objective below 4.0/5.0, the instructor must comment on that course objective. The comments of the instructor may include, but may not be limited to, suggesting changes to the course to better achieve the course objective, suggesting changes to the prerequisite courses to better prepare the students for success in the course in question or suggesting the emendation or even the deletion of the course objective. In this way, each SECS instructor has a pivotal role in improving the quality of both the individual course and therefore the entire program of study.

In the second part of the End-of-Course Summary, each instructor provides specific examples of student work (such as exams, quizzes, and laboratory or project reports) that could be used as direct evidence that students have achieved one or more of the student outcomes. Not all outcomes are expected to be addressed or achieved in any particular course. By listing student work that can be used to demonstrate the achievement of a program outcome, each instructor gains a greater understanding of how his/her course fits into the overall scheme of the program of study and what skills are expected of students as they graduate from the program.

The End-of-Course Summaries for all courses in each SECS department are reviewed regularly by the department chair. The chair filters the comments of the faculty so that only relevant suggestions for program improvement are forwarded to the DUAC for consideration.

Senior Exit Surveys

At the end of each semester in the Senior Design experience, graduating seniors are asked to comment on their entire Oakland University experience, from general education to basic math and science courses to the SECS engineering core to the professional courses to the senior design course. The results of these surveys (Exhibit E.8) can be examined by department chairs, DUACs and the SECS Undergraduate Curriculum Committee (UGCC) for review, prioritization and action.

Alumni Input

The alumni of the SECS, including but not limited to those who attend graduate school at OU, and more recently those who have included themselves in LinkedIn and other social media connections with the departments, are regularly sent e-mail invitations to participate in online surveys (Exhibit E.3). These surveys measure how well the graduates perceive their preparation by the SECS for their first and subsequent jobs, in terms of both the student outcomes and program educational objectives. The results of these surveys can be examined by the SECS Undergraduate Curriculum Committee for review, prioritization and action.

Employer Input

The employers of SECS graduates, as determined by our Advisory Board members, alumni surveys and placement data, are regularly met with in research meetings and recruitment fairs. A portion of these meetings has been set aside regularly to discuss the employer's perceptions of how well their Oakland University employees are prepared by the SECS for employment in the modern engineering world, in terms of both the student outcomes and program educational objectives. The feedback from these meetings is reviewed by the SECS Undergraduate Curriculum Committee for prioritization and action.

Achievement of Student Outcomes

As mentioned previously, the primary metric used to gage the level of achievement of the student outcomes is the assessment by external reviewers of course materials from what are denoted as *key courses*. The key courses selected by the Mechanical Engineering department for the 2013-2014 academic year are:

- **Senior Mechanical Engineering Design Project** (ME 492)
- **Mechanical Systems Design** (ME 486)
- **Energy Systems Analysis and Design** (ME 456) or **Fluid and Thermal Systems Design** (ME 482)[1], (Thermal Systems Professional Courses)
- **Computer Aided Design** (ME 308)
- **Introduction to Fluid and Thermal Transport** (ME 331)
- **Design and Analysis of Electromechanical Systems** (EGR 280)

The set of key courses was chosen to insure that all of the student outcomes are demonstrated and that each outcome can be assessed in more than one course. Although these courses may address many or all of the student outcomes, only a subset of these outcomes is to be evaluated in each course, as shown in Tables 4-1 and 4-2 below. Among the key courses, the multidisciplinary senior design course is the most important one because it delivers all SECS student outcomes.

[1] Undergraduate students are required to complete at least one of these courses

Table 4-1: Student Outcomes Assessed in each Key Course, Fall 2013

Course #	Course Name	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
EGR 280	Design and Analysis of Electromechanical Systems	✓	✓	✓	X	✓	✓	✓		✓	✓	✓
ME 308	Computer Aided Design	✓	✓	✓		✓		✓				✓
ME 331	Introduction to Fluid and Thermal Transport	✓	✓		X	✓		✓		✓		✓
ME 456	Energy Systems Analysis and Design	✓		✓	X	✓	✓	✓		✓	✓	✓
ME 482	Fluid and Thermal Systems Design	✓	✓	✓	X	✓	✓	✓	✓			✓
ME 492	Senior Mechanical Engineering Design Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

X: supplementary metric

Table 4-2: Student Outcomes Assessed in each Key Course, Winter 2014

Course #	Course Name	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
EGR 280	Design and Analysis of Electromechanical Systems	✓	✓	✓	X	✓	✓	✓		✓	✓	✓
ME 308	Computer Aided Design	✓	✓	✓		✓		✓				✓
ME 331	Introduction to Fluid and Thermal Transport	✓	✓			✓		✓		✓		✓
ME 456	Energy Systems Analysis and Design	✓		✓		✓		✓	✓	✓	✓	✓
ME 486	Mechanical Systems Design	✓		✓		✓	✓	✓		✓		✓
ME 492	Senior Mechanical Engineering Design Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

X: supplementary metric

As shown in Tables 4-1, 4-2 and 5-1, all key courses are required (non-elective) courses. This selection was purposely done to ensure that the assessment of the achievement of the outcomes is done in terms of courses that all students are required to take. Materials from the key courses (e.g., design projects, laboratory assignments, etc.) are evaluated at least once a year by external reviewers. The reviewers examine the student work for evidence of the accomplishment of the student outcomes that were identified by the instructor of a given key course and assign a score to the relevant student outcomes using the rating scale shown in Table 4-3. These ratings are then analyzed and weighted averages, based on the ratings and number of reviewers, are calculated to generate an average rating for each outcome.

Table 4-3: Rating Scale Used for the Key Course Evaluations

Score	**Rating**[2]	**Description**
5	Excellent	The assignment clearly requires the demonstration of the program outcome, and all of the student work examined demonstrates the outcome.
4	Good	The assignment provides the students the opportunity to demonstrate the outcome, and most of the student work demonstrates the outcome.
3	Improvement necessary	The assignment as written does not clearly require the student to demonstrate the outcome, or a portion of the student work does not clearly demonstrate the outcome. Comments are required.
2	Below Average	The assignment does not require the student to demonstrate the outcome, or a significant portion of the student work does not demonstrate the outcome. Comments are required.
1	Poor	The assignment has no relationship to the outcome, or no student work shows evidence of the outcome. Comments are required.

Figures 4.2 and 4.3 below illustrate the results of the key course assessment from Fall 2013 and Winter 2014. Figure 4.4 shows the key course assessment results for the three-year period spanning from Fall 2011 to Winter 2014. An average rating of 4.0 or above, in a given category, indicates good achievement of the outcome, and an average rating between 3.5 and 4.0 is deemed satisfactory but could use some improvement. Student outcomes receiving an average rating below a 4.0 would be reviewed by the MEUAC. Except for outcome *d*, the scores shown represent weighted averages of the scores assigned by external reviewers to a given outcome, based on assessment of course materials from the key courses. The scores for outcomes *d* shown in Figures 4.2-4.4 are based on extensive online peer evaluations scores and comments from the ME 492 senior design course (see Exhibit E.7 in Appendix E for sample form). Additional assessment of outcome *d* is performed in other courses (such as ME 331), but is not included in the calculation of the average score; instead they are used as a supplementary metric of those student outcomes. Prior to 2012, the primary metric used to assess outcome *f* was a review of the ethics quizzes in EGR 280 (this is discussed further, below).

As can be seen in Figures 4.2 and 4.3, recent external evaluations of key course materials indicate satisfactory to good achievement of all *a-k* student outcomes, with average ratings of at least 4.0 or higher, except for outcomes *f*, *g* and *i* in Winter 2014 when the average ratings for these outcomes were slightly lower (outcomes *g* and *i* in Winter 2014 were 3.98 and 3.95,

[2] An averaged rating of 3.5 is considered satisfactory, although would still trigger review by the MEUAC.

respectively). This is indicative of the overall healthiness of the program. A review of the average key course assessment data over a 3-year period (Figure 4.4) shows that student outcomes *h, i, and j*, consistently receive lower, though still satisfactory-to-good ratings, than other student outcomes. This is primarily due to the inherent difficulty that reviewers find in assessing students' knowledge of contemporary issues, students' awareness of the need for lifelong learning and students' broad education based on the reports and assignments that were provided for assessment. This situation is by no means unique to OU, as these outcomes have been reported by others as being difficult to assess and external reviewers generally express difficulties with gauging the level of achievement of these outcomes. In fact, even mechanical engineering graduating seniors consistently rated outcomes *h* and *j* lowest among all student outcomes (with average ratings around a 4.0 in all years between 2010 and 2013). It is to be noted that, per Table 5-2, which maps the curricular coverage of the various student outcomes, student outcomes *h, i,* and *j* are also addressed in the variety of General Education courses, as well as several of the professional elective courses that our students must complete; these courses are however not part of the subset of key courses used for the assessment process since key courses must be required of all mechanical engineering students. While the achievement of outcomes *h, i,* and *j* is still satisfactory, we intend to focus some of our future efforts on: *a)* improving the proper selection of materials for the assessment of these outcomes, and *b)* disseminating information among faculty on how to better address these outcomes in their courses.

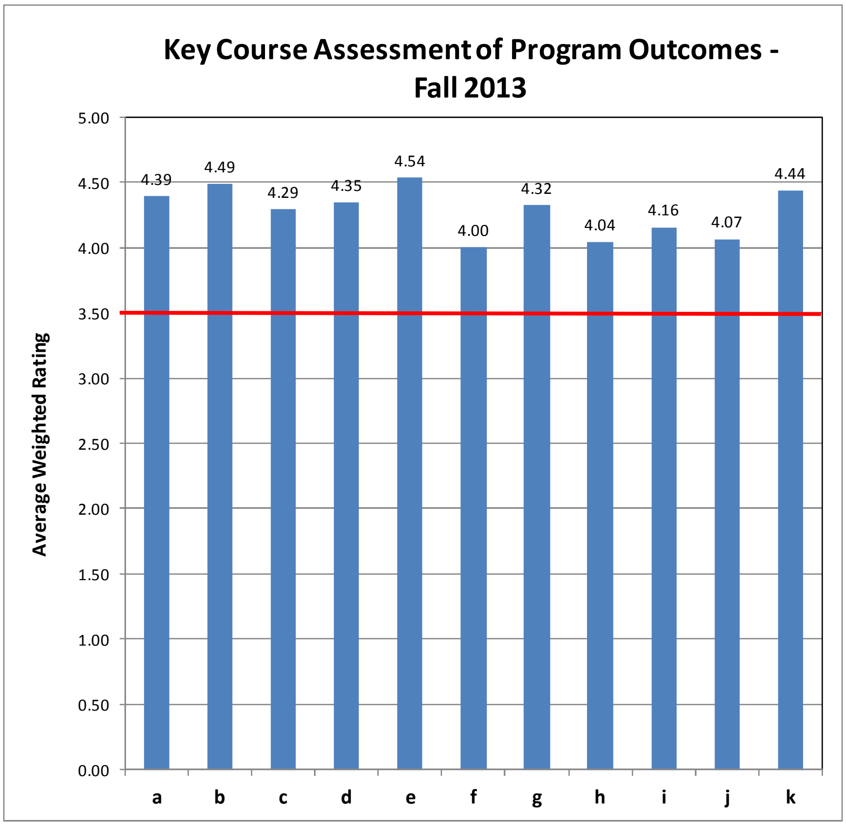

Figure 4.2 Assessment of Student Outcomes *a-k* based on Evaluation of Key Course Materials (Fall 2013)

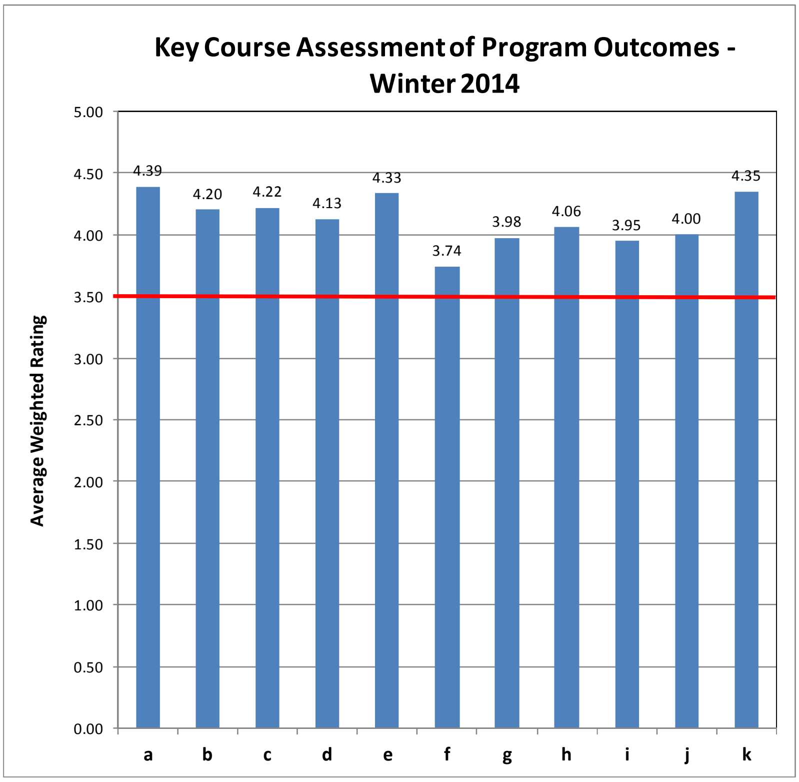

Figure 4.3 Assessment of Student Outcomes *a-k* based on Evaluation of Key Course Materials (Winter 2014)

Students work in teams throughout their studies at OU (including in most core courses, as well as various required and elective engineering courses). However, as mentioned earlier, the primary metric used to assess outcome *d* is the average senior design peer evaluation rating. Each student in the multidisciplinary senior design course, ME 492, is asked to rate the performance of each of his/her team members using the following rating keys:

- **Excellent (100):** Consistently went above and beyond - tutored teammates, carried more than his/her fair share of the work load.
- **Very Good (90):** Consistently did what he/she was supposed to do, very well prepared and cooperative.
- **Satisfactory (80):** Usually did what he/she was supposed to do, acceptably prepared and cooperative.
- **Ordinary (75):** Often did what he/she was supposed to do, minimally prepared and cooperative.
- **Marginal (65):** Sometimes failed to show up or complete assignments, rarely prepared.
- **Deficient (60):** Often failed to show up or complete assignments, unprepared.
- **Unsatisfactory (55):** Consistently failed to show up or complete assignments, unprepared.
- **Superficial (50):** Practically no participation at all.
- **No Show (45):** No participation at all.

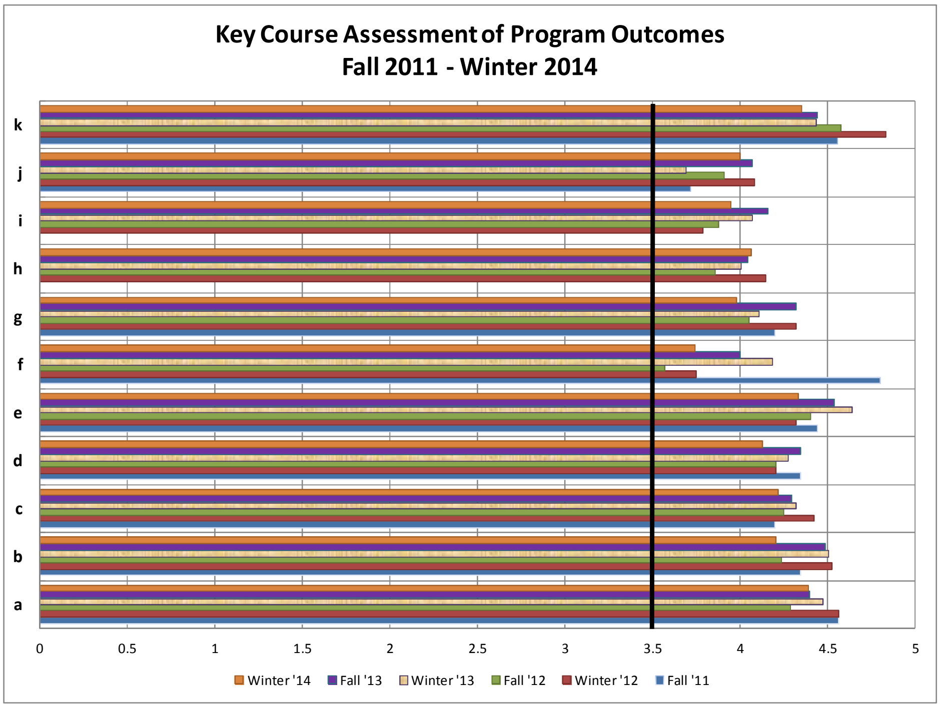

Figure 4.4 Assessment of Student Outcomes *a-k* based on Evaluation of Key Course Materials (Fall 2011 - Winter 2014)

Students are also asked to comment on the performance and contribution of every other student on their design team (See student Peer Evaluation form, Exhibit E.7). For the sake of brevity, the results of online peer evaluations of individual team members are not reproduced here, but will be available for inspection by the evaluation team during the site visit. These results show a high degree of active team participation by the vast majority of team members with average ratings of 91% and 88% in Fall 2013 and Winter 2014, respectively and similar average ratings in prior years. For example, in Winter 2014, only 4 students out of 73 received an average team rating (ATR) below 70%. In fact, 77% of the students received an ATR of at least 80% in Winter 2014. A review of student comments about their teammates in these peer evaluations clearly shows that students do not hesitate to give a low rating to a teammate in cases where problems or conflict arise. This is indicative of the soundness and reliability of the peer evaluation tool.

As can be seen in Figure 4.4, over the past three years, the key course evaluations of outcome *f* (an understanding of professional and ethical responsibility) have often yielded averages between 3.57 and about 4, frequently making it the lowest rated student outcome. The primary materials used to evaluate outcome *f* initially were ethics assignments from EGR 280 and senior design project reports. When the SECS core curriculum was revised in 2005-2006, the intention was for ethics to be taught in EGR 280. However, due to time constraints, engineering ethics was addressed as a minor topic of EGR 280, and coverage eventually consisted of a series of online readings, an online quiz based on the readings and a guest lecture by an ethics professor from the Department of Philosophy. A review of the key course assessment data, faculty end of course summaries and departmental discussions, showed that achievement of student outcome *f*, although acceptable, was not to our full satisfaction and that corrective action was needed. As a result, a new 4-credit course, *PHL 104, Introduction to Ethics in Science and Engineering,* was developed in conjunction with faculty from the Philosophy department to address these perceived gaps, and was approved as a required General Education course for SECS students beginning in Fall 2014. More details about this curricular improvement can be found in Section 4.B.

Although not included here for the sake of brevity, our review of findings from the other assessment tools correlate well with the results of the key course assessment of student outcomes and indicate generally satisfactory/good achievement of student outcomes *a-k*. While we are comfortable with our level of achievement of our student outcomes, as supported by our assessment data, efforts are continuously being made to further improve our program and achievement of the outcomes. Our focus over the next few years will be primarily on further improving our assessment and achievement of outcomes *h, i,* and *j*.

Ultimately, one of the strongest indicators of the preparation of our graduates for professional practice and graduate study can be found in their placement data. Based on a survey conducted by the Office of Career Services, for SECS alumni that graduated between August 2012 and May 2013, 110 graduates out of 126 respondents indicated they were employed, resulting in an employment rate of 87%. Another 10% are pursing graduate or professional school and 1% are pursuing "other commitments," resulting in a placement rate of 98%. The response rate of this survey was 84%.

B. Continuous Improvement

There are a large number of course-level changes that have resulted from the assessment process and faculty discussions. In this section, only some of the more significant program and course-level changes are discussed.

B.1. Improvement to SECS Facilities

One of the most significant improvements that we can report is our upcoming move to a newly constructed campus building. In August 2014, the school will move into the new Engineering Center (EC), a 125,000-square-foot facility that features state-of-the-art classrooms, educational and research space. The new building will serve as the heart of the Engineering and Computer Science community at Oakland University. The need for this new building came to light during the 2004 to 2008 period when faculty and staff discussions and comments in assessment tools such as senior exit surveys and alumni surveys pointed to the need for new and updated laboratory and instructional facilities to better serve our growing student body. Among the wish list for features in a new building was also dedicated space and prototyping/manufacturing facilities that could help foster multidisciplinary teamwork and design in the sophomore and senior design courses.

The EC includes instructional, research and development space designed to foster student learning and creativity, specifically in the areas of automotive, advanced manufacturing, defense, alternative energy, health care, biomedical and other high-tech industries. It includes many new state-of-the-art laboratory, computing and machining facilities including CNC lathes, mills, laser cutters and water jets, 3D printers, as well as equipment to rapidly produce printed circuit boards, just to name a few. We expect these new facilities to further enhance our ability to provide a superior engineering education to our students. More information about the EC building and the labs can be found in section 7 of this report.

B.2. Assessment and evaluation of the Engineering Core Curriculum

The current engineering core curriculum, which consists of a set of 100- and 200-level engineering courses required of all engineering majors, was developed by a group of faculty representatives from each engineering program and was fully implemented in the 2005-06 academic year. The core was conceived as a broad overview to the important topics with which all engineering students need to be familiar, with the depth in those topics left to following courses in specific disciplines. The core curriculum has been managed by the multidisciplinary group of faculty who teach the core courses. While each program is responsible for one or two core courses, the core curriculum "belongs" to the SECS as a whole and is administrated as a collaboration between the SECS departments.

In the years since the core curriculum was introduced, there have been concerns raised by faculty teaching higher level courses fed by the core that students are not sufficiently prepared, most notably in the areas of dynamics, probability and statistics, and programming language and choice. However, assessment data in the core courses and the follow up courses, either directly measured by external evaluations or indirectly by course evaluations or other survey instruments, did not necessarily support the anecdotal comments of faculty. In most core courses, students usually rated achievement of course objectives above a 4 (on a scale of 1 to 5) in their course evaluations and in senior exit surveys, students indicated a general level of satisfaction with the core courses (perhaps in retrospect) as a basis for the professional classes. In the exit surveys, students often commented positively on the design project experience in EGR 280 and mostly gone were, for example, the comments about the need for a CAD course that used to be present in every senior exit survey and most key course evaluations of senior design projects prior to the changes to the core. Yet, other student comments about the core noted a general lack of focus and depth, confusing combinations of topics in some of the courses and concerns about the amount of course material in other courses.

Prompted by these nagging concerns, the UGCC and the core curriculum committee began a comprehensive review of the core curriculum in the fall of 2012. The study began with a review of the course objectives, assessment data and evaluations of each core course over the previous two years, as well as a review of the course objectives and course evaluation in follow-up courses. Since the concerns raised by faculty were generally not supported by assessment data, the UGCC, in conjunction with the core council, developed a series of climate surveys in the winter semester of 2013 to assess faculty and student perceptions about the core, the range of topics covered in each of the core courses, and the value of each core course as perceived by the faculty and students. The results of the surveys (which will be available for review by the ABET evaluators during the visit) demonstrated that

- many students, and most faculty who did not teach core courses, were not aware of the broad goals of the core curriculum, and consequently did not have high confidence that the core was delivering its value to the programs of study,
- most students and faculty believe that the topics covered in the core are appropriate and essential for a broad overview of engineering; however the depth, coverage and combination of those topics in each course are not optimal.

Even though specific suggestions for improvement were solicited in the surveys, few were offered that would not involve a nearly complete overhaul of either the core curriculum, the following engineering programs, or both.

This review of the core curriculum is not closed; it is an ongoing effort. There are clearly opportunities for improvement, however due to the nature of the core, which is common to the various engineering programs, there is very little room for tinkering without widespread restructuring of the engineering programs. More study, assessment and evaluation are needed before specific changes can be recommended. The UGCC and the core committee will be focused on identifying specific curriculum changes during the 2014-15 academic year.

B.3. Addition of a new Nuclear Engineering Option in Mechanical Engineering

Initially prompted by discussions with members of the SECS and the ME Advisory Boards, the ME Department formed a small task force, in Fall 2008, to investigate the possibility of offering and option in Nuclear Engineering within the Mechanical Engineering Program. It appeared that there could be a significant demand for mechanical engineers with some training in nuclear power plant basics. According to the former Assistant Energy Secretary, Dennis Spurgeon[3], *Energy is central to our economic growth, our national security, our standard of living and our way of life. We face significant energy challenges today and there is a sense of urgency when Americans are paying four dollars a gallon at the pump and increasing energy prices are pushing up the costs of other goods and services. Add to this the need to address global climate change and the enormity of the challenge becomes clear.* Secretary Spurgeon was referring to the fact that nuclear power is the only known near-term option for producing the necessary emissions-free base-load electricity, in both in this country and around the world. Further, Secretary Spurgeon noted, *The Department (of Energy) has projected that construction of the currently proposed 15 new reactors could yield approximately: 2,700 pipefitters; 2,900 electricians; 1,800 construction professionals; 600 boilermakers; 2,500 sheet metal workers; and 2,900 iron workers. And keep in mind these job numbers are only for construction. On average, operating a nuclear power facility employs 800 workers and creates hundreds more in the surrounding community. These are high-skill, high paying jobs.* It is important to note that one of the proposed new reactors would be located in Michigan.

In recognition of the above, the SECS began discussions with DTE Energy Company (one of the key employers of our graduates). As a result of these discussions, Professors Kobus and Sangeorzan spent about three months at the Fermi Nuclear Power plant during the summer of 2009. They underwent basic nuclear training and were given access to the power plant and to

[3] Remarks on May 12, 2008, at the 16th Annual International Conference on Nuclear Engineering **(ICONE)**, ASME, Orlando, FL.

training and operational documents, and continue to enjoy the continued support and assistance of Fermi professional staff.

The result was a Nuclear Engineering Option in Mechanical Engineering, approved by the ME Department, the SECS Assembly and the ME Advisory Board. This is not a Nuclear Engineering degree, but rather an option that, along with the broader mechanical engineering curriculum, will give the necessary specialization for a career in the nuclear engineering field. The option includes five courses, two of which are new (ME 479 and ME 480) and one of which is provided by the Physics Department (PHY 318):

- **ME 456** Energy Systems Analysis and Design (4). (Existing course – would be taken as part of the *Required Professional Subjects*)
- **ME 448** Thermal Energy Transport (4) (Existing course - from the ME *Professional Electives*)
- **ME 479** Fundamentals of Nuclear Engineering (3) (New course.)
- **PHY 318** Nuclear Physics Laboratory (2) (existing course in the Physics Dept.)
- **ME 480** Nuclear Reactors and Power Plants (3) (New course)

Importantly, as a regular employer and through our Advisory Board members, the Fermi professional staff are currently supporting the continued development of course content and delivery through guest lectures on specific topics.

B.4. Assessment and improvement of Student Outcome *f - Understanding of professional ethics and responsibility*

In the winter semester of 2012, based on generally substandard metrics seen in Student Outcomes *f*, *h* and *j*, the ECE department requested that the SECS UGCC take up the issue of strengthening the ethics portion of the SECS engineering programs. At the time, engineering ethics was addressed as a minor topic of EGR 280, and coverage consisted of a series of online readings, an online quiz based on the readings and a guest lecture by an ethics professor from the Department of Philosophy.

In order to provide a focus on engineering ethics, the ECE department proposed to the Faculty Assembly the addition of a 1-credit course in ethics, similar in spirit and content to a 1-credit engineering ethics course in the SECS many years ago. Due to the lack of free electives in the engineering programs, which would have necessitated a restructuring of the curricula, and the feeling that engineering ethics deserved more than 1 credit of coverage, the suggestion was rejected by the Faculty Assembly in March 2012.

In October 2012 the UGCC reached out to the Department of Philosophy chairperson, and suggested that a new required course in "ethics and contemporary issues in science and engineering" be developed that would qualify for general education credits. There was immediate interest in this suggestion and work began to develop the course content and draft catalog language requiring the course for SECS students.

As others across campus learned of this course, it was broadened to encompass the sciences, and eventually became *PHL 104, Introduction to Ethics in Science and Engineering*, a course that satisfies the General Education requirement in Western Civilization and developed specifically to address the following course objectives:

- an understanding of professional and ethical responsibility
- an understanding of realistic ethical, social, and political constraints
- an understanding of the impact of engineering solutions in a global, economic, environmental, and societal context
- an understanding of contemporary issues in the professional and political ethics of science and engineering

The course was approved at the college and university levels late in the fall of 2012 and was offered for the first time in the fall of 2013. The course first appeared in the 2013-14 university catalog and will become a required course in SECS as of the Fall 2014 semester. In the meantime, SECS students were strongly encouraged in Fall 2013 and Winter 2014 to take it to satisfy the Western Civilization general education requirement and many students seem to have heeded that call as two sections of PHL 104 were offered in each of the Fall 2013 and Winter 2014 semesters with enrollment in most sections hovering around 40 students.

Assessment of student outcomes *c*, *f*, *h* and *j* in PHL 2014 in the Winter 2014 semester is shown below. Based on these initial results, it appears that the introduction of this course has had a positive impact on the understanding of these important topics. Long-term assessment and evaluation will be necessary to see if this change translates to better understanding of these concepts as they are measured again later in the program.

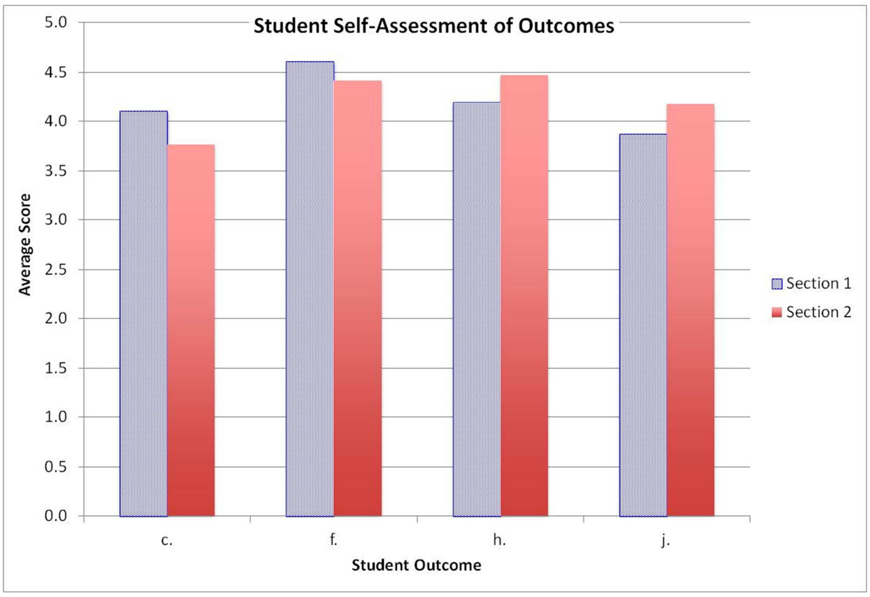

Figure 4.5 Preliminary Assessment of Outcomes in PHL 104

B.5. Assessment and continuous improvement of the senior design experience

Since the senior design experience is a key course in each engineering program, and is an opportunity for all engineering students to demonstrate all of the student outcomes, continuous assessment and improvement of this experience is paramount. The senior design experience is described in detail in Section 5.A. The following is an outline of recent improvements where re-assessment has been completed and/or is underway, and future changes based on recent evaluations and infrastructure changes:

- A lack of formal analysis and modeling, especially in the mechanical portions of the projects, was noted in external evaluations of the final written reports for many years. Two remedies have been implemented to address this concern
    - About six years ago the Mechanical Engineering department made a program change to require ME 308, Computer Aided Design, which also includes an introduction to Finite Element Analysis (FEA). As a result of this change, assessment data has shown a significant improvement as the students required to take this course have proceeded through the curriculum into the senior design experience. Based on this success, further improvements are planned and are described below.
    - Even though formal project proposals have always been required before materials and/or parts would be authorized for purchase, there was a lack of consistency between what was proposed and the final device. In an effort to focus on initial modeling and feasibility, recently detailed models and simulations have been required before the project proposals are approved. While this change cannot be seen directly in improved assessment data, it has anecdotally improved the project flow through the remainder of the semester. Changes planned for the fall 2014 semester (see below) build on this successful change.
- External assessment of the final written reports have consistently shown somewhat disappointing data in the less technical aspects of the reports, most notably in the areas of demonstrating an understanding of professional and ethical responsibility, the impact of engineering solutions in a societal context, and knowledge of contemporary issues. In an effort to strengthen this area, several semesters ago students began to be required to submit nearly-complete drafts of the final reports in an effort to be able to direct their attention to these sections. However, probably due to the timing of the drafts at the end of the semester when most of the focus is on getting the physical systems to function properly, the anticipated improvement in assessment data has not been realized. See below for future changes to re-address this shortcoming.

Changes that will be implemented in conjunction with the new Engineering Center, Fall 2014

- External evaluations of the final written reports and the design proposals, and informal feedback from bystanders and guests at the design competitions, have pointed to an overall lack of planning and design process by student teams. Construction often precedes modeling and analysis, and detailed analysis often follows construction of the device. While some of this can be due to the short time frame of the semester, other reasons include the lack of experience and resources to model and simulate designs, and highly variable fabrication experience among students. These conditions lead directly to construction before analysis is complete, leading to endless tinkering to get physical prototypes working properly.

This issue will be addressed directly with the new resources available in the Engineering Center. Beginning in the fall 2014 semester, each student group will have resources in the new Senior Design laboratory to model, analyze, assemble and simulate their designs within a virtual space. Anything that is to be fabricated must be modeled and analyzed, and a detailed test plan to assess the part must be developed, before fabrication takes place. Parts that are purchased must have a detailed plan to test the component before authorization to purchase is granted. These very important steps in modern engineering practice will be required before authorization is granted to either fabricate or purchase materials, parts or components.

The new CAM facilities of the Engineering Center (CNC lathes, mills, laser cutters and water jets, 3D printers, as well as equipment to rapidly produce printed circuit boards) will greatly reduce the importance of prior fabrication experience among students. Along with the new requirements for prior CAD modeling and analysis before fabrication, it is anticipated that extensive tinkering, and construction before analysis, will be replaced with practices that much more closely resemble modern engineering practice.

- According to data gathered from the external evaluations of the final written reports, the sections that contain the less technical portions (mainly demonstrating an understanding of professional and ethical responsibility, the impact of engineering solutions in a societal context, and knowledge of contemporary issues) have always been lacking in depth and quality, despite the feedback given on final report drafts. Beginning in the fall 2014 semester, students will be given the requirements of the final report on the first day of class, and will be required to show progress towards acceptable written demonstrations of these topics throughout the semester, hopefully relieving the time pressure that naturally occurs towards the end of the semester. It is anticipated that earlier attention to these sections, along with continuous feedback throughout the semester, will result in greatly improved applied understanding of these important topics, higher quality reports and improved assessment results.

Additional changes that are being considered:

- Assessment of the peer team evaluations has indicated that, even though the experience seems to be a positive one for the vast majority of students, some groups are highly challenged to focus on the project and not on inter-personal relationships within the group. Resources are being actively sought to help these students manage their groups better. Changes that are being considered range from mandatory workshops on functional group dynamics, supplying written materials on best practices for engineering design groups, to providing more support for functional work practices.

B.6. Changes to EGR 240, Introduction to Electrical and Computer Engineering:

Background - EGR 240 is the only core course required by all disciplines within the School of Engineering and Computer Science. As such, the course must provide a strong introduction to the fundamental, discipline independent, aspects of engineering as represented by ABET outcomes *a*, *b*, *e*, *k* and to a lesser extent *c*. EGR 240 also serves as the gateway course into the Computer Engineering curriculum and directly feeds the gateway course into the Electrical Engineering curriculum (ECE 276). Therefore, while introducing the students to the fundamentals of engineering the course must also adequately prepare EE or CE majors for their chosen degree field. For ME students, this course is important in that it is the only required course in the area of electrical circuits, digital logic and electromechanical machines.

Soon after adopting the core, it was discovered that EGR 240 was not adequately preparing students for the EE curriculum. A follow-on course was developed as a bridge between the core and the EE curriculum. This course, ECE 276 – Electric Circuits, became the gateway course to the rest of the EE program. It was believed that this new course would adequately meet the needs of the department. At the time, only minor changes were made to EGR 240.

After a few years, it became clear, through the external evaluation process, that adding ECE 276 did not completely meet the needs of either the CE or EE programs. Many of the changes to EGR 240 were made in response to feedback from faculty, generated by our external evaluation system. Student feedback from EGR 240 has historically been very positive. The majority of students rated their understanding of the course objects as excellent to good, but student demonstration of these skills was lacking, which lead to a re-teaching of the basic principles in follow-on ECE courses. In response to these issues an ECE faculty member was assigned the task of reviewing and updating the course. He spent the first semester sitting in the course and the lab to review the material. He has spent the last 4 semesters updating various aspects of the course.

Course Review (prior to changes) and Changes Made in Response - EGR 240 was previously taught with the goal of getting students excited about engineering and introducing them to various topics of Electrical and Computer Engineering. All engineering students are required to take the course and it was determined by the ECE faculty that the homework assignments were not challenging enough for electrical or computer engineering majors. Questions required students to repeat what was shown in lecture and few questions required any analytical thought. To remedy this issue, homework now consists of two parts, “Entry-Level Problems” and “Advanced Problems”. Entry-level problems assess the students’ grasp of the basic concepts and bolster their confidence, whereas advanced-level problems require a deeper understanding of the concepts. These problems exist to push the student to a deeper understanding, to generate questions, and to introduce students to methods for attacking unfamiliar engineering problems. The change to homework helps to expose students who are weak at analysis or design. With this information the professor and, more importantly, the student can begin to remedy the problem before they move onto other courses. *[a, c, e, k]*

Due to the level of difficulty of the homework that was originally assigned, the exams consisted of simple multiple-choice questions. The questions often required few if any calculations and no design. The students were only required to demonstrate a very basic understanding of the topics covered in class, exactly as they were covered. No variations were made to problem statements or how the questions were posed. The result being that students gained a false belief that they understood the concepts, but when faced with a slightly different problem or a problem requiring multiple steps, they would perform poorly. To address this issue, exams are no longer multiple-choice. They now contain five problems. Problem 1 contains ten multiple-choice problems that require a few simple calculations. Problems 2 – 5 are long-answer problems where students are required to design and analyze various problems. Long-answer problems typically require multiple related steps. For example, students may be asked to design a digital control circuit for a simple wall following robot or apply nodal analysis to a circuit containing voltage sources, which are not tied to the ground node (Supernodes). *[a, c, e, k]*

It was also determined that labs included too much procedural detail. By providing precise instruction in every lab, for setting up, connecting, and recording measurement data, the students never learned how to use the equipment or why they were recording a particular quantity. Every student was able to achieve a 100% on laboratory work simply by completing the lab. Nowhere was the student required to process or interpret the data. Hence, the ECE faculty decided to rework every lab assignment to remove the overly precise details. Since EGR 240 is the first engineering lab experience in the curriculum, the early labs provide a significant amount of detail about what measurements to record and how these measurements are recorded. These instructions are reduced in each subsequent lab. By the final lab students are asked to measure a quantity, but no instructions are provided concerning how to measure this quantity. To introduce the students to interpreting and reporting data, simple lab reports are now required in nearly every lab assignment. The students are asked to answer lab questions in their report. These questions require the students to properly interpret the data they recorded. Pre-labs were also added to prepare students for the lab. *[b, e, g, k]*

The changes discussed above have taken place over a number of semesters, so the assessment results are still unclear. However, it appears that students still rate the course well, and the ECE external assessments have all been very positive. The ultimate test of these changes will primarily be seen in the rest of the EE and CE curriculum. It will take a few years to determine the overall effect of the changes to EGR 240, however, anecdotally, the faculty have noticed that:

- Students are asking more and better questions both in the lecture and lab portions of the course
- Students are able to use measurement equipment and have some ability to recognize when they get a measurement that doesn't make sense.
- Students are more eager to learn and are more capable of learning on their own.
- Students are better prepared to tackle complex problems with which they have little experience.

B.7. Changes to EGR 250: Introduction to Thermal Engineering

Background: EGR 250 is a core course that introduces students to fundamental principles foundational to all engineering disciplines. While most of the course is focused on the concepts of thermodynamics, additional topics on heat transfer modes, one-dimensional conduction, convection heat transfer and fins are covered to meet the needs of EE, CE and other majors. The course also has a significant laboratory component that requires students to complete laboratory assignments in teams, perform detailed analysis of experimental and theoretical data and generate detailed laboratory reports for each laboratory assignment. Although the course covers a lot of material and some faculty would occasionally report difficulties with covering the topic of fins due to time constraints, students generally rate achievement of the course objectives somewhere between excellent and good and in the core survey recently administered by the UGCC, faculty reported the highest satisfaction level with this core course.

Issues:

- Student outcome *i, a recognition of the need for, and an ability to engage in life-long learning*, has been reported to be one of the more difficult student outcomes to assess in external evaluations of key course materials and it consistently receives some of the lowest ratings.
- A review of student written reports from EGR 250 and from key courses sometimes shows a great deal of variability in the quality of the written reports.

Changes Made:

- Modifications were made to several EGR 250 laboratory assignments requiring students to seek out published information on their own, evaluate the reliability of sources of information and summarize what they have learned. For example, in the "Measuring the Energy Content of Food" laboratory assignment students are provided a gelatin capsule filled with an unknown food sample and are tasked with determining the contents of the unknown food sample by determining its energy value per unit mass (Calories/gram) by burning it in an Oxygen bomb calorimeter device and relating the measured temperature rise in a water bath to the amount of energy released by the food sample during the combustion process. This requires not only performing a very detailed and precise experiment, but also developing a mathematical theoretical model based on the conservation of energy principle to relate the measured temperature rise to the energy value of the food sample. Students collect data, plot it, analyze it, perform calculations (including an uncertainty analysis for which they need to locate instrument manufacturer data sheets) and compare their result to published nutritional information that they must seek out for a few different possible food items. Using this information and taking into account the experimental uncertainty, they must determine the identity of their food sample. Beginning in winter 2013, students were also required to research approved standardized ways set by the Food and Drug Administration (FDA) of determining the caloric content listed in nutritional labels of packaged food items and were required to comment on the reliability of their sources of information.

- While students have long been provided with extensive feedback on their EGR 250 written lab reports as well as with a laboratory report guidelines handout, revisions have been made to the laboratory report guidelines to make them clearer and more detailed grading rubrics, which could be provided to students prior to lab report submission, were developed in Winter 2013. Although it is still too early to assess the impact of these changes, the faculty member teaching the course reported less variability in the laboratory report content and quality after these changes were implemented.

B.8. Changes to EGR 280 Design and Analysis of Electromechanical Systems (Sophomore Design)

Flipping the Classroom in EGR280 (Design and Analysis of Electromechanical Systems) **–** EGR 280 is a multidisciplinary course that is team-taught by an ECE and an ME faculty member, includes a 3-hour per week laboratory that is an integral part of the course and serves as a kind of **sophomore capstone design course** for the core. The first six weeks of the course cover microprocessors interfacing using C with an emphasis on controlling DC motors and servos. This is followed by mechanical engineering topics including statics and dynamics, as well as topics on ethics. Towards the end of the semester, students work in multidisciplinary groups to complete a project involving a microprocessor-based electromechanical system.

EGR 280 attempts to provide students with an overview of engineering mechanics. Students are then expected to apply the knowledge gained to a project design. Students receive about 6 weeks of instruction in both statics and dynamics. Materials covered for statics include basics such as units, problem solving, etc., a vector review, and survey of particle equilibrium, moments, equivalent systems, rigid bodies, trusses, frames, machines, and static friction. Emphasis is placed on correctly identifying forces and free body diagrams. The dynamics topics covered are general motion of particles (kinematics), forces and acceleration, gears and motors (pure rotation), work and energy and impulse and momentum.

Based on exam grades and student perceptions and end-of-course evaluations, the instructors felt that teaching EGR 280 in a traditional format (lecture in class, HW outside of class) was not the best way to approach this class. Course objectives for statics and dynamics, which are covered in the second half of the semester after the ECE material, typically score below 4.0 and student comments often complained about the amount of material covered and the lack of a textbook. In Winter 2014, a flipped class room approach was attempted. Students were provided links to reading and pre-recorded lectures. To ensure that students read the materials and watched the lectures, a brief quiz or problem was given after each assignment due before the corresponding class period. Materials were borrowed with permission from an online course developed by Kurt Gramoll of Oklahoma University. It was expected that students would then be prepared for class. In class a brief 10-15 review lecture was given and the remainder of the class period was devoted to problem solving as groups or as individuals. This change was in large part due to the continual time crunch felt while trying to cover all the required material for this class. It was felt that class time could be better used for example problem solving if students reviewed the materials in advance of each class period.

In winter 2014, the statics portion received a composite average rating of 3.7 for the combination of students at Macomb and Oakland. The exam score for this portion of the course was significantly lower than the average for past years. This may be related to a number of issues. Foremost was that with the already time-pressed course there were three snow-days due to frigid winter that we experienced this year. Course materials were compressed even further than usual allowing for only minimal “soak time”. When issues like this arise, typically the poorer students suffer, because less time is spent reviewing the requisite physics and calculus background materials. Second, based on comments from the students, there was a bit of a learning curve on their end in that they had to learn to discipline themselves to study the online materials and go out and find the background information that they needed on their own. It took students time to realized that they were expected to spend several additional hours outside of the class room setting for each lecture period to be successful in this class.

Issues with dynamics were similar to those encountered in the statics portion of the course. From the implementation stand point, things went more smoothly with the flipped classroom approach as students had started to get used to it. Despite being listed as a course objective, general rigid body dynamics were not covered due time constraints. The composite average rating for Macomb and Oakland students was 3.8 in winter 2014. The main issue in teaching dynamics is the compressed format. Students have approximately 3 weeks to cover the required materials. In some sense students were more successful in dynamics than they have been in previous semesters. The average exam score in this term was 80% which is higher than in previous years. The instructors felt that the course objectives were met, even though the students seem to disagree in their assessment.

This was the first attempt to flipping the classroom in EGR 280. Although the course objectives scores stayed at the old levels, the instructors do see some promising improvements. In fact, it is not uncommon to see course evaluation scores drop the first time that a new pedagogical methodology is implemented in a course. The instructors look forward to taking some lessons from this first attempt and continue to improve their offering of a flipped classroom. Student end-of-course evaluations and external assessment results of the Fall 2014 offering should provide data that allows the assessment of the effectiveness of this change.

B.9. Changes to Required Course ME 308 Computer Aided Design

Prior to the adoption of the new engineering core in 2005-2006, various assessment metrics had highlighted the need for a required computer aided design course as part of the ME curriculum. In particular, in student responses to 2001-2002 and 2005 senior exit surveys, about 76% of students reported gaps in their background based on their senior design project experience, and most ME students reported that CAD instruction was lacking and that an introduction to CAD/CAM and Computer Aided Engineering tools would better prepare them for their career. The ME department also found that 10 out of 10 benchmarked ME programs have a required CAD course. Furthermore, assessment of student skills coming into the Senior Mechanical Engineering Design Project (ME 492) course by instructors and external evaluators showed that not all reports included appropriate detailed drawings of design in senior design projects and student CAD and CAE skills (which pertain most to outcome *k*) were in need of improvement. As a result of the adoption of the new core curriculum, the CAD/CAM/CAE issue was addressed starting with the 2005-2006 catalog by requiring all SECS students to first take a one-credit introduction to solid modeling and CAD tools course in their freshman year (EGR 120) and then requiring all ME students to take a three-credit Computer Aided Design course (ME 308), which also includes an introduction to Finite Element Analysis (FEA).

Subsequent assessment of the impact of this curriculum change shows that it did indeed address the problem. Between 2010 and 2013, the rating for student outcome *k* in the senior exit surveys can be seen to be steadily increasing (as changes in the curriculum have propagated through the various student cohorts, most of whom take more than 5 years to complete their degree), going from a 4.1 to a 4.4 on a 5-point scale (where a rating of 4 equals good and a 5 is excellent). Comments by seniors about any perceived gaps in their background no longer point to CAD/CAM or CAE. More importantly, external evaluation of outcome *k* in our key course assessment process yielded an average rating of 4.57 between 2011 and 2014 and external evaluators no longer point to deficiencies in the CAD/CAM and CAE areas in their written comments. (See Student Outcome k in Figures 4.1-4.3). Furthermore, anecdotal feedback from the senior design course instructors indicates that they no longer see student preparation in the CAD and FEA areas as issues in the course.

Naturally, as with all courses, the faculty who teach the course will continue to look for ways to improve the course and the curriculum. For example, in Alumni Surveys, a few students have suggested more preparation *geometric dimensioning and tolerancing* (GD&T). In the original ME 308 syllabus, GD&T was to be covered, but the instructors felt that elementary finite element analysis was more vital to the senior design course, and so GD&T was dropped for time considerations only. The department is considering means to include GD&T in the curriculum. Additionally, the department recently hired a full-time Special Instructor to oversee and teach EGR 120 and ME 308. Hopefully, his full-time commitment to these courses will further improve the content delivery to the students.

B.10. Changes to Professional Elective ME 484/584

The department had been offering two elective Automotive Engineering classes, ME484/584 and ME684. ME484/584 was a cross-listed undergraduate/graduate course, called *Automotive Engineering Design I*, and ME684 was called *Automotive Engineering Design II*. The courses were taught by a full-time faculty member, but then around 2006 part-time instructors, with specialized experience, were recruited to teach these courses. With OU's location in the heart of the automotive industry, many working graduate students had significant experience in automotive engineering, while undergraduates may have had little or no experience. In the Course Evaluations, several students complained that the material was not appropriate for both graduate and undergraduate students. Also, in the End-of-Course Summaries, and through discussions with the department chair, three different part-timers and the full-time faculty member all felt that the undergraduate students (ME 484) and graduate students (ME 584) had significant background and experience differences that presented difficulties for the instructors, in terms of appropriate course content. Therefore, in 2009, the department decided to split ME 484 and ME 584 into two different courses; ME 484 became *Vehicle Dynamics*, focusing on analyses of vehicle dynamics, and ME 584 (graduate) became Automotive Chassis Systems, focusing on drive train analyses and tire dynamics. These more focused and specialized courses serve undergraduate and graduate students better, and the students and faculty seem to be much more satisfied with the course.

B.11. Departmental Review of Courses and Faculty Course Delivery

As described in section *A. Student Outcomes*, under Criterion 4 above, the department chair reviews the student End-of-Course Evaluations each semester and often takes action or refers action to the MEUAC. In most cases, the chair would see student comments about the quality of the course, or the effectiveness of the instructor. A pattern of negative comments may cause the chair to speak to the course instructor, or to other faculty who teach the same course, or even to Advisory Board members. Below are two examples of action taken by the chair, triggered by reviews of the student evaluations.

Removal of Professional Elective ME 477, *Concurrent Engineering* - ME 477 was a professional elective that had been offered by the department, using part-time instructors, to address an engineering/manufacturing trend in the early 2000's. Students, through the course evaluations, were reasonably satisfied with the course, but, in personal discussions with the department chair, expressed the opinion that the course was too ‘soft’ and lacked the rigor normally associated with engineering courses. The department chair discussed the course content with the instructor and reviewed course materials, and came to the same conclusion that was expressed candidly by several students. The chair discussed the matter with MEUAC, which agreed, as did the ME Advisory Board, and the department agreed to drop the course from the catalog, beginning with the Fall 2009 semester.

Faculty Course Delivery - While virtually every faculty member in the ME department can be described as a dedicated teacher, some faculty have strengths or weaknesses that bias them toward graduate or undergraduate or special topic areas. Occasionally, in reviewing the End-of-Course Evaluations, the chair may find a pattern of complaints about a specific instructor in a specific course. When that happens, the chair will speak with the instructor and may also consult other faculty who teach in the same discipline. In the case of part-time instructors, they may not be invited back to teach that course again. In the case of full-time faculty, they might be moved to other courses. In at least two cases in the past four years, faculty have been moved to other courses to improve the perception of course delivery by the students and to place faculty where they can be most productive. This process is sometimes unpleasant, but evidence that the student End-of-Course Evaluations are taken seriously by the department.

B.12. Revision of ME Course Pre-Requisites

Since the new Engineering Core had been in place for about three complete (admission to graduation) student cycles, the ME Department re-assessed the pre-requisites for all of its courses. Numerous changes were made to reflect course-level and program-level changes to both required courses and professional electives. These changes were affected based on faculty End-of-Course Summaries and subsequent departmental discussions. The faculty who are normally associated with a given course worked together to review and revise the pre-requisites and the department met as a whole to approve the changes.

B.13. Addressing Ethics, Team Work, and Lifelong Learning; Supplemental Assessment in ME 443 Polymeric Materials and Other Courses

In ME Department meetings to discuss student Course Evaluations and faculty End-of-Course Summaries, the issue of addressing some of the less technical Student Outcomes arises almost every semester. Many faculty have tried to address those outcomes in their courses, even if they are not teaching one of the key courses. As an example, the issues of ethics, teamwork and lifelong learning were addressed in ME 443 *Polymeric Materials*. This course deals with general topics in plastics, focusing mainly on structure-property relationships as they apply to the use of plastics in engineering applications, and changes were made to deal with ethics, teamwork and lifelong learning in the following ways.

Ethics: Since plastics are so prevalent throughout society, there are a wide variety of ethical issues that must be addressed in specifying their use. Problems arise often not from the plastics themselves but from the additives used to modify polymer properties for a specific application. One such example is the use of the plasticizier, Bisphenol A (BPA). In high concentrations BPA was recently found to act as an estrogen mimic which causes a number of potential health concerns. As a result of public outcry, BPA has now been removed from the majority of consumer products, despite what appears to be a lack of clear evidence that the concentrations of BPA in consumer plastics is sufficiently high to be of any real concern. In an interesting twist, most of the studies stating that the concentration of BPA is too low to be of concern have been funded by the suppliers of the BPA, which places validity of such studies in some doubt. In ME 443 students were asked to read an article discussing the use / disuse of BPA, the apparent conflicts of interest of the parties involved in funding the studies, and the paradoxes involved in research studies and funding sources in general. The article was discussed in class. The students were also given an open-ended essay question on their midterm exam asking them for their thoughts on the conflicts of interest and bias brought up by this article.

Team Work: On the first day of class students are divided up into groups of 3-4 students. Group work is assigned as follows. The class format for ME 443 consists of a combination of traditional lectures, hands-on lab experiments, and student presentations. The lectures are designed to give a high level overview of the course material. For each general topic area discussed in class a worksheet is distributed amongst the students ahead of the lecture for that topic. Each team is assigned to investigate one or two questions on the worksheet before they are discussed in class. At the appropriate time during the lectures, teams are asked to address their assigned worksheet questions. This serves to establish a team dynamic early in the class and keeps the class somewhat interactive. For homework, student teams are each assigned topics to study in depth which are then presented to the class as a 15-20 minute lecture. For example, the instructor might cover polymer processing in a general sense in class and have each student team prepare a brief lecture and 2-page memo on specific topics such as injection molding, extrusion, blow molding, thermoforming, or rotational molding. These presentations and reports are peer evaluated by the students in the class using a rubric developed by the instructor. Four such assignments are given through out the semester. Lab reporting is also done as a team effort.

Lifelong Learning: As a final project for the course, each individual student is asked to investigate a topic of his/her choosing related to a recent development in the field of polymers from no later than 3-5 years ago. Specifically students are encouraged to find a recent journal article as a starting point for their research. The instructor works with the students in advance to help focus their search and topic. During teamwork exercises students are taught to seek primary literature sources so they should have sufficient skills by the time the final projects are due to find good articles on their own. Students are also encouraged to seek out references from within the selected paper to help with the background materials and build understanding of their subject. Students create a brief memo for their topic and present their findings to the class during the last week of class. Peer evaluation is used to evaluate each presentation.

As a professional elective, this course is not evaluated as part of our key course assessment process, but serves as an example of the attempt by faculty to improve achievement of Student Outcomes throughout the curriculum. A supplemental review of this course shows the students are very satisfied with the course; the average student score for the four course objectives was 4.6 (out of 5; Winter 2014), and student comments included statements such as, "the course was great I enjoyed the material and the **format**" (team work) and, " this course has inspired me to learn more about plastics and materials in general" (lifelong learning).

While we don't have a formal external assessment of outcomes *d* (teamwork), *f* (ethics) or *i* (lifelong learning) in ME 443, we are considering selecting various courses for supplemental assessment in different semesters as a measure of improving the replication of coverage of the outcomes that have been more challenging to assess. For example in ME 331, Introduction to *Fluid and Thermal Energy Transport*, we assessed Outcome *d* (teamwork), based on student peer evaluations. In Fall 2013, the average student rating for Outcome *d* was 4.50 (recall that our primary metric for *d* is ME 492). External evaluations of Outcome *i* (lifelong learning) in that same semester averaged 4.0, but in Winter 2014, that rating dropped to 3.86 perhaps due to differences in how students were instructed to address this issue in their reports. Also in ME 331, in an attempt to improve report writing, Outcome *g* (communication) was assessed almost every semester between Winter 2012 and Winter 2014, with average scores varying between 4.14 and 4.40.

C. Additional Information

During the November 2014 ABET site visit, course materials from the key courses used to assess the achievement of the student outcomes will be arranged by the student outcomes a-k. For each student outcome, the assignment handouts, the actual student work that was externally evaluated, the external evaluations of the student work, a summary of the external evaluations, the student end-of-course evaluations and faculty end-of-course summaries will be available for inspection. In addition, other supporting student work, student evaluations and faculty summaries from other selected, non-key, courses, senior exit surveys, alumni and employer surveys will be available for review by the visiting team.

CRITERION 5. CURRICULUM

A. Program Curriculum

The mechanical engineering curriculum, shown in Table 5-1, satisfies all ABET requirements, including 28 credits of general education, 32 credits of mathematics and science, 21 credits of engineering core, 35 credits of required professional subjects, and 12 credits of professional electives. Twelve (thirteen with ME 482) of the 15 required EGR and ME courses listed in Table 5-1 have associated hands-on or computer laboratories. Many more professional electives also include laboratories. EGR 280 includes a substantial sophomore design experience, and capstone design experiences are achieved in ME 492 and/or in ME 490.

Table 5-1 Curriculum

Bachelor of Science in Mechanical Engineering

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.	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]
First Semester of Freshman Year							
EGR 120 Engineering Graphics and CAD	R		1 ( )			Fall '13 Winter '14	137 100
MTH 154 Calculus I	R	4				Fall '13 Winter 2014	60,64,64, 60,64,64 60,60,60, 60,60,65
CHM 143 Chemical Principles (or CHM 157 or CHM 162)	R	4				Fall '13 Winter '14	25, 35, 63, 49 59
EGR 141 Computer Problem Solving in Engineering and Computer Science	R		4 ( )			Fall '13 Winter '14	95, 85 120, 80
One course from General Education Program	SE			4			
Second Semester of Freshman Year							
MTH 155 Calculus II	R	4				Fall '13 Winter '14	70, 70, 60 68, 68, 65
PHY 161 Fundamentals of Physics I	R	4				Fall '13 Winter '14	50, 50 46

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.	Course is Required, Elective or a Selected Elective by an R, an E or an SE.[1]	Subject Area (Credit Hours)				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]
		Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other		
EGR 240 Introduction to Electrical and Computer Engineering	R		4 ( )			Fall '13 Winter '14	110 12 (MUC) 100, 34 16 (MUC)
One course from General Education Program	SE			4			
First Semester of Sophomore Year							
APM 255 Introduction to Differential Equations and Matrix Algebra	R	4				Fall '13 Winter '14	70, 80 60, 60
PHY 162 Fundamentals of Physics II	R	4				Fall '13 Winter '14	50 71
EGR 250 Introduction to Thermal Engineering	R		4 ( )			Fall '13 Winter '14	40, 50 48 30 (MUC)
One course from General Education Program	SE			4			
Second Semester of Sophomore Year							
MTH 254 Multivariable Calculus	R	4				Fall '13 Winter '14	60, 60 60, 60
EGR 260 Introduction to Industrial and Systems Engineering	R		4 ( )			Fall '13 Winter '14	54 25 (MUC) 65 25 (MUC)

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.	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]
EGR 280 Design and Analysis of Electromechanical Systems	R		4 (✓)			Fall ‘13 Winter ‘14	75 12 (MUC) 70 16 (MUC)
One course from General Education Program	SE			4			
First Semester of Junior Year							
ME 322 Engineering Mechanics	R		4 ( )			Fall ‘13 Winter ‘14	25 30 (MUC) 50
ME 331 Introduction to Fluid and Thermal Energy Transport	R		4 ( )			Fall ‘13 Winter ‘14	38 40
ME 372 Properties of Materials	R		4 ( )			Fall ‘13 Winter ‘14	40 44
One course from General Education Program	SE			4			
Second Semester of Junior Year							
ME 308 Computer Aided Design	R		3 (✓)			Fall ‘13 Winter ‘14	30 20
ME 361 Mechanics of Materials	R		4 ( )			Fall ‘13 Winter ‘14	30 30
One course from General Education Program	SE			4			
One course from Math or Science Elective	SE	4					

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.	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]
First Semester of Senior Year							
ME 421 Vibrations and Controls	R		4 ( )			Fall '13 Winter '14	35 30
ME 486 Mechanical Systems Design	R		4 (✓)			Winter '14 Winter 2013	33 38
ME 456 Energy Systems Analysis and Design or ME 482 Fluid and Thermal Systems Design	R		4 (✓)			Fall '13 Winter '14 Fall '13 Fall 2011	30 42 15 15
One course from General Education Program	SE			4			
Second Semester of Senior Year							
ME 492 Senior Mechanical Engineering Design Project Or ME 490 Senior Project	R		4 (✓)			Fall '13 Winter '14 Fall '13 Winter '14	100 100 0 0
Three courses from Professional Electives	E		12 ( )				
Add rows as needed to show all courses in the curriculum.							

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.		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]
TOTALS-ABET BASIC-LEVEL REQUIREMENTS			32	68	28			
OVERALL TOTAL CREDIT HOURS FOR COMPLETION OF THE PROGRAM		128						
PERCENT OF TOTAL			25 %	53 %	22 %	0 %		
Total must satisfy either credit hours or percentage	Minimum Semester Credit Hours		32 Hours	48 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.

“The major goals of Oakland University’s **General Education** program are to introduce students to a broad base of knowledge and to develop their analytical and evaluative skills, creating a solid foundation for productive and fulfilling lives of leadership, innovation and service.” The general education program undergoes continuous review by the General Education Committee, a standing committee of the OU Senate. All OU students are required to complete at least 40 credits of general education, including at least one course from a list of approved courses offered in each of the following 10 knowledge areas: Writing Foundations and Formal Reasoning, Arts, Foreign Language and Culture, Global Perspectives, Literature, Natural Science and Technology, Social Science, Western Civilization, and Knowledge Applications. Additional general education requirements include U.S. Diversity, Writing Intensive in General Education, Writing Intensive in the Major, and a Capstone, all of which may be met by judicious selection of the approved general education courses. For ME students, this means that at least 28 credits must be taken outside the Math and Science or SECS course rubrics. The general education requirements contribute to Program Educational Outcomes 2 and 3.

The **mathematics and science requirements** provide the foundation for the engineering courses. These 32 credits include 16 credits of mathematics, 8 credits of physics, 4 credits of chemistry, and 4 credits of an approved math or science elective. The math/science elective is chosen from a list of approved courses in mathematics, biology, chemistry, or physics. The mathematics and science requirements contribute to all three PEO’s, but most directly to objectives 1 and 2.

The **Engineering Core** is taken by all engineering (computer, electrical, mechanical, and industrial and systems) students, and includes: the fundamentals of circuit theory and digital logic, an introduction to thermodynamics and heat transfer, probability and statistics, and an introduction to microprocessors and linear systems statics and dynamics, culminating in a sophomore design experience in EGR 280. Additionally, in an effort to connect with and retain students as they work through their math and science requirements, the core includes freshmen courses in computer graphics and CAD, and computer problem solving. The engineering core provides a broad engineering background for all engineering students with laboratory experiences in electrical, mechanical and computer labs. The laboratory components address report writing and presentation, and teamwork, relevant to program educational objective 3. The engineering core contributes to all three educational objectives.

The **Required Professional Subjects** introduce fundamental concepts in traditional mechanical engineering disciplines and provide the broad technical education important for every mechanical engineer. Five of the required courses include hands-on or computer laboratories (six with ME 482) that generally require group reports or presentations. Additionally, the professional subjects provide the pre-requisites for the professional electives and the capstone design experience (ME 492).

All students are required to complete a **capstone design experience**. For most ME students, this requirement is satisfied through ME 492, which is a multi-disciplinary team experience in engineering design, including students from all engineering disciplines through their respective capstone design courses (ECE 491, ISE 491). Alternatively, some students will enroll in ME

490 to satisfy the capstone design requirement. In ME 490, a small team of students will work closely with a faculty member, on a design project of mutual interest. Students wishing to enroll in ME 490 must complete an application and project proposal that must be approved by the MEUAC. Senior Design courses, ME 490 and ME 492, have identical Student Outcomes. The capstone courses require peer teamwork assessment, written and oral reports, and typically participation in a student project exhibition that is open to the public. The required professional subjects contribute to all three PEO's.

The **Professional and Free Electives** complete the curriculum for mechanical engineering majors, allowing students to gain depth in areas of individual interest. It is common that students satisfy their writing proficiency requirement using free elective credits. The professional and free electives may contribute to any of the program educational objectives.

Overall, adequate time and attention are given to each curricular component, consistent with the outcomes and objectives of the program and the institution. Undergraduate catalogs from the 2009-2014 periods will be available for review by the visiting team in November, 2014.

The mechanical engineering curriculum, outlined in Table 5-1, has features that have been common to all engineering programs at Oakland University since the School was established in 1965. These common features include:

1. <u>Laboratories</u> are included as part of most engineering courses. Nine (ten with ME 482) of the 15 required EGR and ME courses listed in Table 5-1 have laboratories associated with the course, and three have computer laboratories. This gives OU engineering students more hands-on laboratory experience than students at most similar engineering programs in the state.
2. The <u>engineering core</u>, shared by all engineering programs, introduces students to the interdisciplinary nature of engineering and lays the foundation for specialized study in the students' major field of study. Topics outside of mechanical engineering include: computer science fundamentals (EGR 141), electrical circuits and digital logic (EGR 240), statistics and fundamentals of systems engineering (EGR 260), and microprocessors and electromechanical systems (EGR 280). These courses contribute not only to increased multi-disciplinary problem-solving skills, but also provide knowledge that is particularly useful in the automotive industry, a specific requirement for program educational objective number 1.
3. An emphasis on <u>systems engineering</u> has always been a hallmark of the engineering programs at Oakland University. While undergraduates can major in systems engineering in the Industrial and Systems Engineering department, all departments participate in the Ph.D. program in Systems Engineering. All engineering students take EGR 260 and EGR 280 as part of the engineering core. The emphasis on systems engineering is particularly appropriate in the automotive industry (PEO # 1) where today's automobiles and trucks are true systems involving the integration of mechanical, electrical, and computer systems.

Major Design Experience

Since the 2004 academic year, the SECS has offered a unique major design experience to its students. The major features of this experience are:

- **True multidisciplinary experience**. Design groups are assigned to be composed of students majoring in computer, electrical and mechanical engineering (and occasionally industrial and systems engineering). The design groups are assigned a project that requires knowledge, skills and backgrounds spanning all of these areas. The groups are supervised by a multidisciplinary team of instructors from the Electrical and Computer Engineering and Mechanical Engineering departments, assisted by project consultants from the SECS machine and electrical shops.
- **Real-world projects that involve realistic constraints**. The projects pursued in the senior design experience always involve the design, modeling, analysis, construction and testing of an electromechanical device that must perform a specific task, or that meets a global market need. The experience always ends with a public exposition and competition between the student groups. While the projects assigned are often scaled to be completed within a single semester, the technology, techniques, engineering standards and professional practice required to complete the projects successfully are not diminished. Some of the more recent projects have been:
    - autonomous devices that sort up to 2000 Skittles® candies by color
    - autonomous robots that race through a slalom course between small cones
    - autonomous robots that climb stairs, follow lines and retrieve objects
    - autonomous robots that locate and extinguish candles

  Multiple, realistic constraints such as safety, reliability, manufacturability and feasibility are discussed and handled on a routine, daily basis. For the last several semesters the OU Senior Vice President for Academic Affairs and Provost has funded the SECS senior design experience as an example of undergraduate research, providing the opportunity for realistic budget justification, tracking and reimbursement.
- **Continuous feedback to students**. Each student group meets at least weekly with the instructors to submit written progress reports, present its progress from the previous week and receive specific feedback on plans for the coming week. In these meetings students also receive feedback on their mid-term and final oral presentations, project proposals and final written reports.
- **Assessment capstone**. The senior design experience has been designated as an OU General Education major capstone course as well as qualifying as a writing-intensive course in the engineering majors. In addition, the course objectives of the senior design experience are exactly the student outcomes a-k, and the student deliverables of the experience have been tailored to readily assess the student outcomes of the program.

Per the instructions provided to the senior design students every semester, the main criteria used by the course instructors when evaluating and grading the senior design projects and reports include:

- Modeling, analysis and hardware/software development
- Use of all applicable engineering standards
- Systems approach, design considerations and backup solutions

- Oral and written presentations, and actual system demonstrations
- Creativity and uniqueness from design concept to implementation
- Project progress, consistency and completion

Additional instructions are provided to students from each major. For example, ME students are instructed to "Identify subcomponents on which potential critical points can be identified for failure. Thoroughly analyze these points through finite element analysis, stress analysis, relevant application of failure criteria, fatigue analysis (especially for shafts), fracture analysis, etc., as appropriate. Use the results of the analyses to perform optimization of the parts for minimum weight and/or minimum cost."

The OU/SECS senior design experience has been the topic of 4 papers presented at ASEE and national capstone design conferences. The assessment of, and the recent and planned changes to, the SECS senior design experience are described in Section 4.B, above.

Cooperative education

Due to our location in the heart of the automotive industry, a large number of ME students are employed at the automotive manufacturers or suppliers as interns and cooperative education students. While co-op employment provides practical training related to a student's field of study and forms an integral part of the educational program, co-op experience does not satisfy any curricular requirements.

Relationship of Courses in the Curriculum to the Student Outcomes

Student outcomes are achieved by the accumulated achievement of individual course objectives. Each course objective contributes to one or more student outcomes (as shown in the course syllabi in Appendix A). The course objectives for a given course need not address all student outcomes. However, over the entire curriculum all student outcomes will be accomplished as shown by the mapping of courses to student outcomes in Table 5-2. This table shows that each outcome is addressed by several courses within the curriculum. In most cases, there should be repetition, particularly in required subjects, so that an outcome can be considered as demonstrated several times throughout the curriculum.

For more detail on a particular course, refer to the course syllabus given in Appendix A. The course descriptions indicate specific linkages between the individual course objectives and the Student Outcomes. A coordinating faculty member produced each course description, which was then reviewed by the faculty sub-group in that teaching area and by the MEUAC.

Table 5-2 - Curricular Coverage of STUDENT Outcomes

Course #	Course Name	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
General Education Courses (excl. Math & Science)							✓	✓	✓		✓	
Math and Science Courses:												
MTH 154-155	Calculus	✓										
APM 255	Introduction to Differential Equations with Matrix Algebra	✓										
MTH 254	Multivariable Calculus	✓										
CHM 143	Chemical Principles	✓										
PHY 161-162	Introductory Physics	✓										
Appr. Math or Sci. Elect	MTH, APM, PHY, CHM, BIO	✓										
Engineering Core:												
EGR 120	Computer Graphics and CAD	✓	✓			✓		✓		✓		✓
EGR 141	Computer Problem Solving in Engineering and Computer Science	✓	✓	✓	✓	✓			✓			✓
EGR 240	Introduction to Electrical and Computer Engineering	✓	✓	✓		✓						✓
EGR 250	Introduction to Thermal Engineering	✓	✓		✓	✓	✓	✓		✓		✓
EGR 260	Introduction to Industrial and Systems Engineering	✓	✓			✓					✓	✓
EGR 280	Design and Analysis of Electromechanical Systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Required Professional Subjects:												
ME 308	Computer Aided Design	✓	✓	✓		✓		✓				✓
ME 322	Engineering Mechanics	✓	✓		✓	✓	✓	✓				✓
ME 331	Introduction to Fluid and Thermal Energy Transport	✓	✓		✓	✓	✓	✓		✓		✓
ME 361	Mechanics of Materials	✓	✓			✓		✓				✓
ME 372	Properties of Materials	✓	✓		✓	✓		✓		✓		✓
ME 421	Vibrations and Controls	✓	✓	✓		✓						✓
ME 486	Machine Design	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ME 456, or ME 482	Energy Systems Analysis, or Fluid and Thermal Systems Design	✓		✓	✓	✓	✓	✓		✓	✓	✓
		✓	✓	✓		✓		✓				✓

Course #	Course Name	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
ME 490, or ME 492	Senior Mechanical Engineering Design Project, or Senior Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Professional Electives:												
ME 423	Acoustics and Noise Control	✓	✓	✓	✓	✓		✓				✓
ME 438	Fluid Transport	✓	✓		✓	✓	✓	✓				✓
ME 443	Polymeric Materials	✓				✓			✓		✓	✓
ME 448	Thermal Energy Transport	✓				✓						✓
ME 454	Solar and Alternate Energy Systems	✓				✓						✓
ME 456	Energy Systems Analysis	✓		✓	✓	✓	✓	✓		✓	✓	✓
ME 457	Internal Combustion Engines I	✓				✓			✓		✓	✓
ME461	Analysis and Design of Mechanical Structures	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
ME 467	Optical Measurement and Quality Inspection	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
ME 472	Materials Properties and Processes	✓				✓		✓	✓			
ME 473	Flexible Manufacturing Systems	✓	✓	✓	✓	✓	✓					✓
ME 474	Manufacturing Processes	✓	✓	✓	✓	✓		✓				✓
ME 475	Lubrication, Friction and Wear	✓				✓	✓	✓	✓		✓	✓
ME 476	Product and Process Development	✓				✓						✓
ME 478	Robotic Systems	✓	✓	✓	✓	✓	✓					✓
ME 479	Fundamentals of Nuclear Engineering	✓				✓						✓
ME 480	Nuclear Reactors & Power Plants	✓		✓		✓	✓		✓	✓	✓	✓
ME 482	Fluid and Thermal Systems Design	✓	✓	✓		✓		✓				✓
ME 484	Vehicle Dynamics	✓				✓	✓	✓	✓		✓	✓
ME 487	Mechanical Computer-Aided Engineering	✓	✓			✓		✓		✓		✓
ME 488	Mechanical Computer-Aided Manufacturing	✓	✓	✓		✓	✓	✓	✓		✓	✓
ME 489	Fasteners and Bolted Joints	✓	✓	✓		✓	✓	✓				

Prerequisite Flow Chart

Figures 5.1 – 5.3 illustrate the prerequisite structure of courses required or allowed towards a mechanical engineering major.

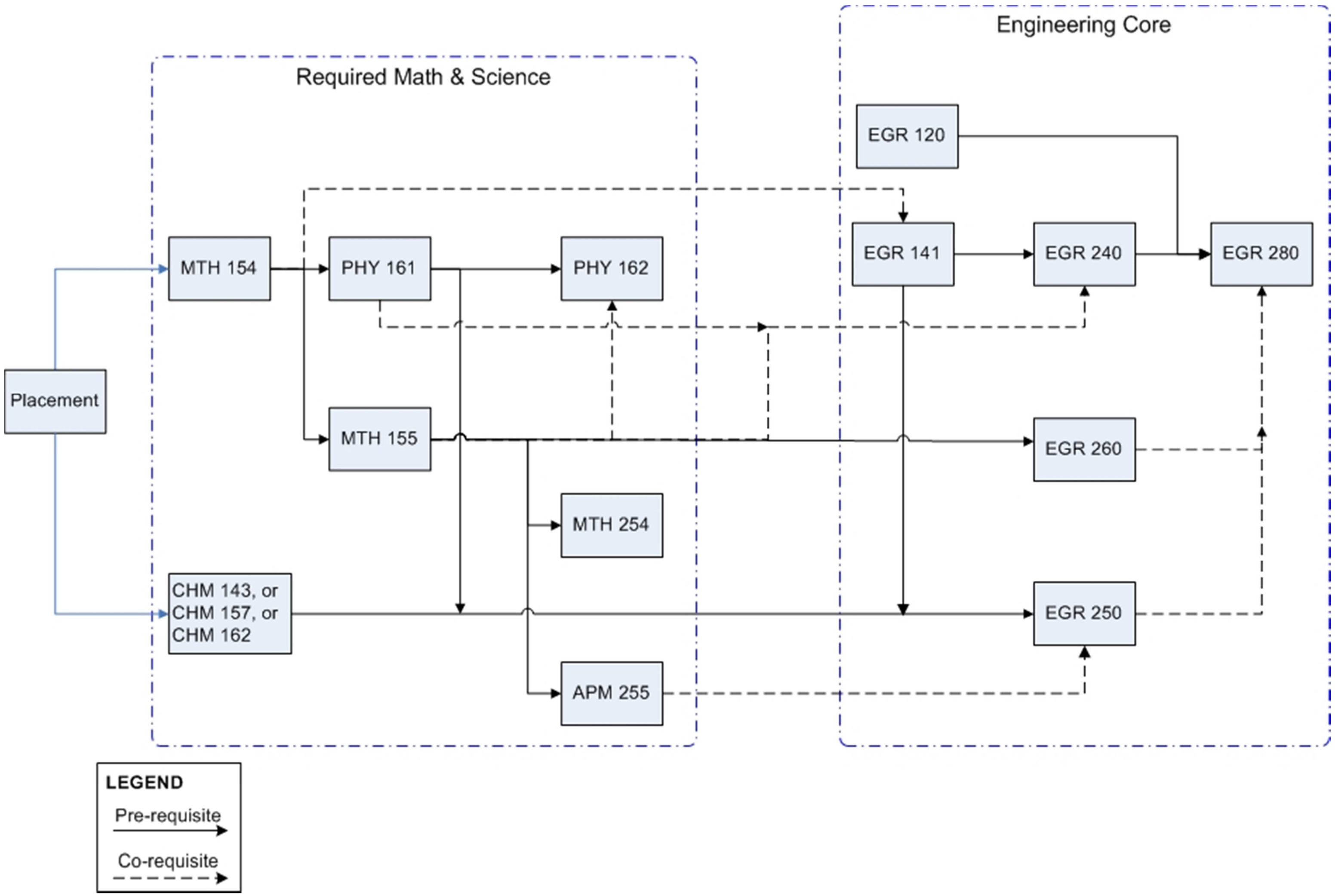

Figure 5. 1 Flow Chart Illustrating the Pre-Requisite Structure for the Engineering Core

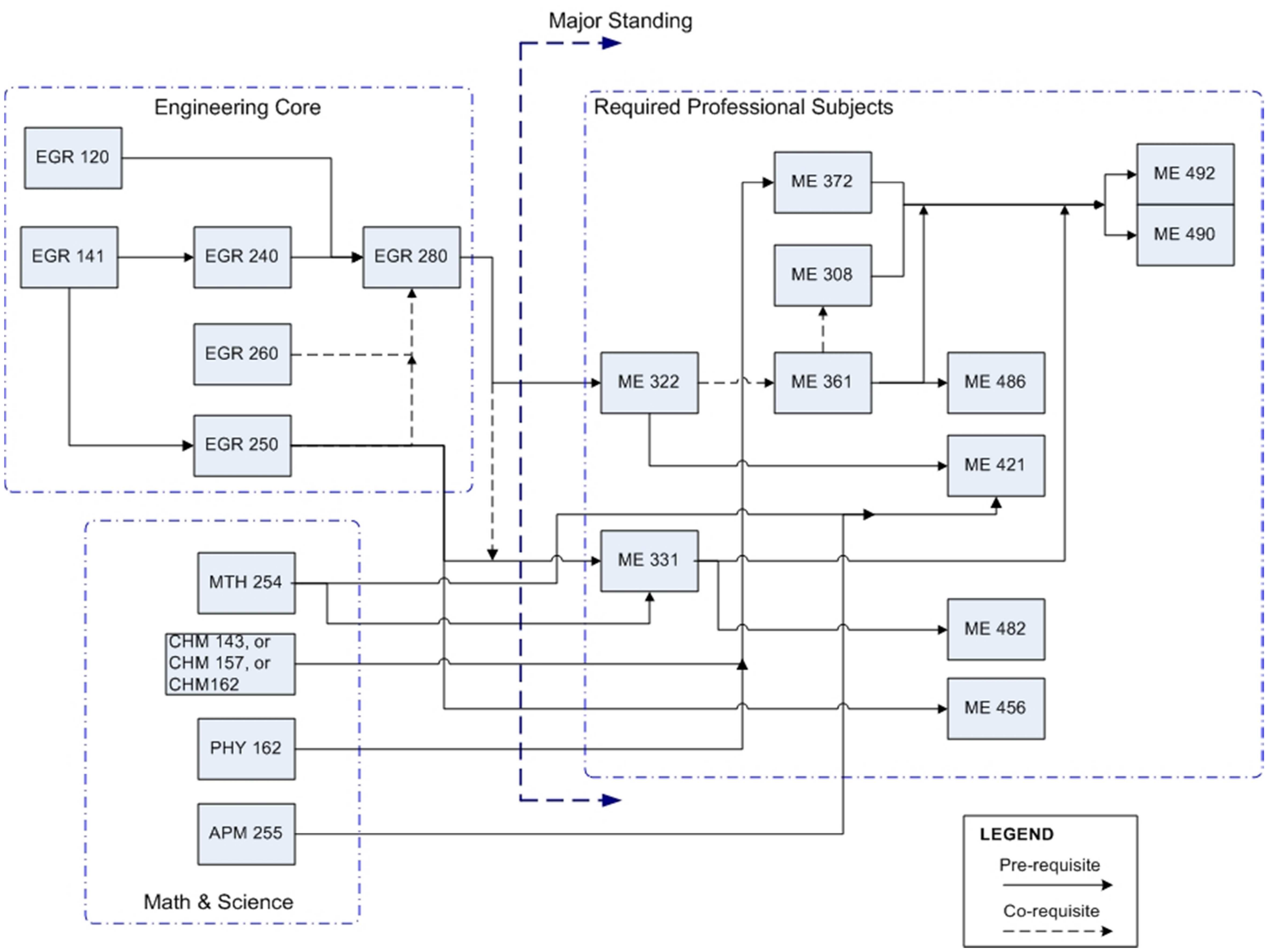

Figure 5. 2 Flow Chart Illustrating the Pre-Requisite Structure for the Required Professional Subjects

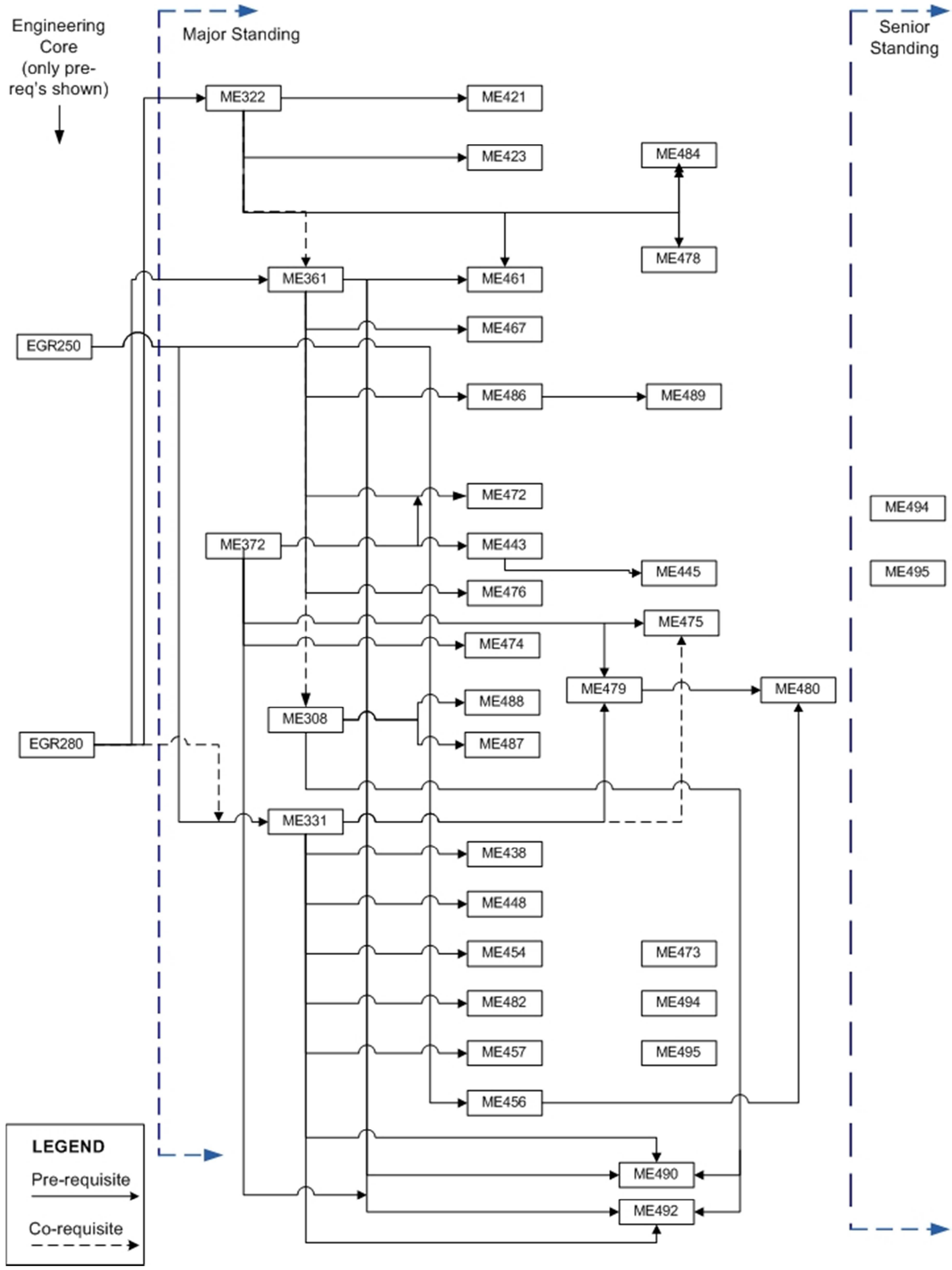

Figure 5. 3 Flow Chart Illustrating the Overall Pre-Requisite Structure Required Including Elective Professional Subjects

Materials Available During the Team Visit

Evaluators will have access to course materials during the visit which demonstrate achievement of student outcomes. The materials will include course binders and course file boxes for each undergraduate course.

The Course Binders will include:

- Syllabus
- End-of-Course Summary (from our online course evaluation system)
- Any handouts distributed to the class
- Assignments, such as Exams, Lab Assignments, Homework, Special Projects
- Student Outcome Mapping to student materials.

The Course File Boxes will include the student work:

- Course textbook
- all exams
- sample completed homework assignments
- sample lab reports
- any special projects or assignments

B. Course Syllabi

Syllabi for courses used to satisfy the mathematics, science, and discipline-specific requirements required by Criterion 5 can be found in Appendix A.

CRITERION 6. FACULTY

A. Faculty Qualifications

All of the tenured and tenure-track faculty hold earned doctorates in their fields. Three hold state engineering licenses and four others have completed at least the EIT exam. All of the faculty maintain active research activities, and most maintain some level of industrial consulting. Four (Barber, Yang, Mourelatos, Nassar) faculty hold one or more titles of ‘fellow” within their professional organizations.

All of the adjunct and part-time faculty hold earned doctorates in their fields. One exception (Edwards) holds an M.S. and industrial experience and teaches an ISE course that is cross-listed with ME. Please refer to Table 6-1, below, and Appendix B.

B. Faculty Workload

The faculty are very enthusiastic about teaching. All ranks share similar teaching loads. The normal teaching load is two courses per semester (fall and winter). The Department Chair can reduce this teaching load for faculty with substantial research activities or substantial service obligations if all courses can be taught by remaining faculty with appropriate expertise. Faculty members also share in the undergraduate advising process with our professional advisors. The large majority of the faculty are engaged in more than one research project sponsored by industry and governmental agencies. Service activities are fairly distributed, although it’s common for some of the more senior associate and full professors to take on slightly larger service roles. Many of our faculty assume significant service roles to the profession, including leadership roles within professional organizations such as STLE, ASME and SAE, and also chairing and organizing conferences and technical sessions.

C. Faculty Size

The Department of Mechanical Engineering currently has 16 tenure-track faculty lines. Two new faculty (one associate professor and one special instructor) have been hired and will start in fall 2014. Since the last ABET review, one new assistant professor (Schall) has been hired. Professor Mourelatos assumed the duties of Department Chair in the fall of 2011. The breakdown by faculty rank is:

- 9 full professors
- 6 associate professors
- 1 assistant professor

The size and competence of the faculty is enhanced by extremely competent adjunct and part-time faculty from the surrounding industry. Allowed by its location in the center of the automotive industry, the department regularly draws upon the talents and interest of qualified professionals to add depth and breadth to the curriculum and to continue to offer new classes that meet the demands of a changing marketplace. Officially, there are 6 adjunct faculty in the department. These are individuals with whom the department has had a long-term, continuous relationship, and who often contribute in other roles such as advising graduate students and contributing to research programs. Additionally, the department employs part-time lecturers to teach courses in their areas of expertise, many of whom have a continuing relationship with the department. The adjunct and part-time faculty are typically practicing professionals who hold a Ph.D. in their field. The students and the curricular areas of the program are well served by this faculty.

In addition to regular office hours, ME faculty have always made themselves available to meet with students for their academic questions (homework, exams, etc.) as well as for career advising. The ME faculty size is sufficient to teach the undergraduate courses and staff all faculty committees. With the continued growth in student population, owing in part to our international relationships, outreach efforts, continuous improvement of the engineering job market in Southeast Michigan, and the desire to keep our class sizes small, the department has hired two additional faculty staring in fall 2014; an Associate Professor in Advanced Manufacturing and a Special Instructor in CAD/CAM. The Department has also submitted a request for two additional faculty members in 2015.

D. Professional Development

Funds for faculty travel for professional development are allocated to academic units in accordance with the Oakland University AAUP faculty agreement. These funds are used to reimburse faculty members for attendance at local, state and national professional or scholarly meetings. Within the School of Engineering and Computer Science, the Dean makes allocations to the departments. Department Chairs determine priorities from the requests that they receive for travel. The amount per ME faculty member available during 2013-14 was an average of $984. In making allocations, preference is generally given to faculty members presenting papers. Other funds are augmented from administrative travel sources and from gift account funds. Additional travel funds are available from research grants and contracts.

Also, the SECS and Oakland University have incentive programs, primarily for providing greater opportunity for faculty travel. Under these programs, a faculty member is encouraged to make a donation to the School. The Dean matches all such gifts up to a maximum of $400, and the university's President provides a 50% match on all donations. The total amount of the donation and the match can be used for travel as well as for dues to professional societies. The departments also use a portion of their discretionary funds for faculty travel.

The university expanded its own faculty development programs with the establishment of the Center for Teaching and Learning (CETL), in March 2011. The mission of the CETL is twofold: *To support faculty efforts to improve teaching by creating learning environments in which our* *diverse student body achieves maximal learning potential, and to promote a culture throughout the university which values and rewards effective teaching, and respects and supports individual differences among learners.* The CETL sponsors conferences and offers many faculty development opportunities including: workshops, consultations, faculty development institutes and learning communities. Several ME faculty have been very involved CETL activities.

Faculty professional development activities have been itemized in the Faculty resumes in Appendix B. Some examples of professional development activities of Mechanical Engineering Faculty during the past year are as follows:

- Gary Barber: Attended STLE Annual Meetings and SAE World Congress; Associate Editor, Tribology Transactions; Associate Editor, Handbook of Lubrication and Tribology; Editor of Automotive Tribology Section of Encyclopedia of Tribology; Seminar Committee Member, STLE Detroit Section; Member of Program Committee, International Seminar on Modern Cutting and Measuring Engineering.
- Yin-ping Chang: Attended ASME International Design Engineering Technical Conference, SAE World Congress, ASEE national and regional education seminars and conferences; Member of SAE Tire Tests for Road-Load Tire Model Parameters Task Force Committee; Program Organizer of SAE World Congress Conference; Member of ASME Vehicle Design Committee, Mechanical Design Division; Reviewer of journals/conferences/NSF proposals.
- Randy Gu: Organizer and Chair of the CAD/CAM/CAE Session, SAE World Congress; Member of the International Scientific Committee, International Conference on Engineering Optimization; Associate editor of the International Journal of Passenger Cars - Mechanical Systems.
- Laila Guessous: Attended ASME IMECE Conference, SAE World Congress, ASME Summer Heat Transfer Conference; Regularly attend seminars hosted by OU Center for Excellence in Teaching and Learning; Executive Board Member of Michigan Space Grant Consortium; Exhibits/Sponsorship/Publicity Chair of the 2014 ASEE NCS Conference; Chair or co-chair of technical sessions at various ASME conferences, including ASME IMECE, ASME Summer Heat Transfer Conference, ASME Fluids Engineering Conference; Member of the K-20 Committee on Computational Heat Transfer, Heat Transfer Division of the American Society of Mechanical Engineering (ASME); Reviewer of technical journals and conferences; NSF Panel reviewer.
- Michael Latcha: Reviewer and regional conference organizer of ASEE; Attended Moodle Training, Oakland University e-Lis; Regularly attend the seminars hosted by the Center for Excellent Teaching and Learning.
- Keyu Li: Chair of the Residual Stress Technical Division at SEM; Organizers and chairs of the sessions for SEM Annual Conference and Exposition on Experimental and Applied Mechanics; Reviewers of journals/conferences/NSF proposals.
- Ching Long Ko: Attended NSF Workshop on Mechtronics and NASA Workshop on Computational Fluid Dynamics; Member of AIAA Technical Committee on Aircraft Design.
- Chris Kobus: Track Chair, Topic Chair, and Session Chair for many ASME Conferences; Member of ASME HTD K-8, K-21 committees; Chair of the ASME K-21 committee;

Member of the Automation Alley Education and Workforce Committee; Member of the Michigan Jobs and Energy Coalition; Conference Co-organizer of the Michigan Bioenergy Conference; Green Living Festival sub-committee member of the Oakland County Tech Prep Consortium; Member of the Green Renewable Energy Outreach sub-committee.

- Zissimos P. Mourelatos: Attended SAE World Congress and ASME Design Engineering Conferences; Member of Organizing Committee, Modeling and Simulation, Testing and Validation Mini-Symposium; Member of the ASME Design Engineering Division Nominating Committee; Member of Scientific Committee, International Conference on Engineering Design; Member of Scientific Committee, NSF Workshop on "Reliable Engineering Computing"; Organizer and session chair of multiple SAE, and ASME sessions; Associate Editor of the ASME Journal of Mechanical Design; Founding Editor-in-Chief of the International Journal of Reliability and Safety; Associate Editor of the SAE Journal of Materials and Manufacturing; Member of the Editorial Board, International Journal of Turbines Engineering.
- Sayed Nassar: Attended ASME and SEM conferences; Member of NASA-wide team; Guest Associate Editor of the ASME Journal of Pressure Vessel Technology; Co-Editor of ASME-PVP peer-reviewed Proceedings; ASME Topic/Symposium Organizer, Session Developer/Chair/ Co-Chair; Reviewer of journals and conference proceedings.
- Brian Sangeorzan: Attended SAE World Congress and SAE Detroit section education seminars and technical meetings; Regularly attend the seminars hosted by the Center for Excellent Teaching and Learning; Organizer, Chair or Co-Chair for several technical sessions at professional meetings for SAE, ASEE, STLE and AIAA; Reviewer of SAE Transactions in the areas of Diesel Engines, Advanced Powerplants, Engine Heat Transfer, and SI Engine Combustion; Numerous governing board positions within the SAE Detroit Section; Numerous officer positions in SAE International.
- James Schall: Attended the annual meetings of the Society of Tribologists and Lubrication Engineers, American Vacuum Society, and Materials Science and Technology; Chair and co-chair of the Tribology Focus Session, American Vacuum Society; Officer of Surface Engineering Technical Committee, Society of Tribologists and Lubrication Engineers; Reviewer of journals and conference proceedings.
- Xia Wang: Attended ASME Fuel Cell Science Conference, Engineering and Technology Conference, Electrochemical Society Annual Meetings; Regularly attend the seminars hosted by the ECS Detroit, and other local industries; Officer of the Electrochemical Society, Detroit section; Track co-organizer for Symposium on Applications in CFD at Joint US-European Fluids Engineering Division summer meeting; Track co-organizer and session chair at ASME Fuel Cell Science, Engineering and Technology Conference; Reviewer of journals, conferences, NSF proposals, and Hong Kong Research Council proposals.
- Lianxiang Yang: Attended SPIE, ASNT, SEM and SAE conferences; Regularly attend the Stamping Committee, Steel/Auto Partnership Committee monthly or bi-monthly meetings; Associate Editor, SAE International Journal of Materials and Manufacturing and Journal of Optical Engineering; Associate Technical Editor, Journal of Material Evaluation; Editorial Board, Journal of Optics and Lasers in Engineering, Journal of Mechanical Engineering, Chinese Society of Mechanical Engineering, and the International Journal of Holography and

Speckle; Chair and Vice Chair, Material Modeling and Testing Committee, the International Society of Automotive Engineers; Organizer and Chair of multiple sessions, Optical Techniques in Automotive Engineering, SAE Annual World Congress.

- Qian Zou: Attended STLE Annual Meetings, ASME/STLE International Joint Tribology Conference, SAE World Congress, STLE Detroit section education seminars and technical meetings; Regularly attend the seminars hosted by the Center for Excellent Teaching and Learning; Editorial board member of ISRN Tribology and the International Journal of Powertrains; Panel reviewer of Nature magazine; Technical editor of Tribology & Lubrication Technology; Reviewer of journals/conferences/NSF proposals; Session organizer of Automotive Tribology session, SAE World Congress; Session Chair of STLE Annual Meetings, SAE World Congress, International Conference on Wear of Materials, and STLE/ASME International Joint Tribology Conference; Officer of Wear Technical Committee, the Society of Tribologists and Lubrication Engineers; Membership Chair of STLE Detroit Section.

E. Authority and Responsibility of Faculty

A single department Chair and one clerical assistant serve the department. Zissimos Mourelatos is the current Mechanical Engineering Department Chair. The Chair is advised by the departmental faculty, a departmental Advisory Board and informally by student organizations such as ASME, SAE, SME and Tau Beta Pi. The department Chair meets at least once per year with the Advisory Board, and meets regularly with the ME Undergraduate Affairs Committee (MEUAC). The chair also meets monthly with the deans and other department chairs within the SECS.

Faculty within the department are informally organized into groups according to whether they primarily teach in the solid mechanics area, the fluid and thermal sciences area, or the manufacturing engineering area. The informal faculty groups work together to develop teaching assignments, course objectives, undergraduate laboratory needs and other curricular matters. The MEUAC is the formal body for all departmental, undergraduate curriculum matters. The department must approve all mechanical engineering curriculum changes, proposed by the MEUAC. The chair of the MEUAC also serves as a representative in the SECS Undergraduate Curriculum Committee. Any curriculum change that involves a change to the Undergraduate Catalog, must be brought through the SECS Undergraduate Curriculum Committee to the SECS Faculty Assembly for approval. Changes to the Undergraduate Catalog require a majority vote by the assembly.

The SECS assessment process, described in the section *Achievement of Student Outcomes*, under Criterion 4.A, ensures the consistency and quality of the courses taught. In particular, the student End-of-Course Evaluations and faculty End-of-Course Summaries for all courses are reviewed by the department chair each semester. Concerns or recommendations for improvement that arise from this review are conveyed to past and new instructors, as well as to the DUAC for further action.

The Department Chair has the responsibility of assigning department faculty and teaching assistants to courses, encouraging faculty to seek external support for their research, allocating budget resources to cover department needs, coordinating course scheduling, and interacting when necessary with other university organizations. The Chair also serves as a member of the SECS Salary Committee that allocates annual merit salary increases among SECS faculty, when applicable by contract. The Department Chair also coordinates all outreach activities with respect to recruiting undergraduate and graduate students as well as interaction with industry.

Table 6-1. Faculty Qualifications

Name of Program: 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: Govt./Ind. Practice	Years of Experience: Teaching	Years of Experience: This Institution	Professional Registration/ Certification	Level of Activity [4] H, M, or L: Professional Organizations	Level of Activity H, M, or L: Professional Development	Level of Activity H, M, or L: Consulting/summer work in industry
Alexandros Alkidas	PhD, Mechanical Engineering, 1987	A	A	PT				N/A			
Gary Barber	PhD, Mechanical Engineering, 1987	P	T	FT	4	27	24	N/A	M	M	M
Turgay Bengisu	PhD, Mechanical Engineering, 1993	A	NTT	PT	27	10	10	PE	L	H	N/A
Bhushan Bhatt	PhD, Mechanical Engineering, 1978	P	T	FT	0	44	15	N/A	L	L	M
Yin-ping Chang	PhD, Mechanical Engineering, 2002	ASC	T	FT	3	15	12	N/A	H	H	L
William Edwards	MS, Mechanical Engineering, 2003	A	NTT	PT	20	14	3	PE, MI	M	M	M
Randy Gu	Ph.D., Mechanical Engineering, 1984	P	T	FT	1	32	30	EIT, MI	L	H	L
Laila Guessous	Ph.D., Mechanical Engineering, 1999	ASC	T	FT	1.25	13.5	13.5	EIT, NC	M	M	L
Ching Ko	PhD, Mechanical Engineering, 1985	ASC	T	FT	5	30	29	PE, MI	L	M	L
Christopher Kobus	PhD, Mechanical Engineering, 1998	ASC	T	FT	0	16	16	N/A	L	M	L
Michael A. Latcha	PhD, Mechanical Engineering, 1989	ASC	T	FT	0	33	28	EIT/FE	L	L	H
Keyu Li	Ph.D., Mechanical Engineering, 1993	P	T	FT	0.5	21	19	N/A	M	M	L
Zissimos P. Mourelatos	PhD, Naval Architecture and Marine Engineering, 1985	P	T	FT	18	28	12	N/A	H	H	M
Rodrigue Narainen	Ph.D, Mechanical Engineering, 1993	I	NTT	PT	19	2	2	N/A	M	H	H
Sayed Nassar	PhD, Aerospace Engineering, 1981	P	T	FT	4	29	14	N/A	H	L	H
Vijitashwa Pandey	PhD, Systems Engineering, 2008	I	NTT	FT	1	4	4	N/A	H	M	M

Johann Pankau	M.S., Applied Mechanics,1990	A	NTT	PT	24	4	4	N/A	L	L	H
Brian Sangeorzan	Ph.D, Mechanical Engineering, 1983	P	T	FT	2.5	30	30	PE, WI	H	M	H
J. David Schall	PhD, Materials Science and Engineering, 2004	AST	TT	FT	3	7	5	N/A	H	M	M
Arun Solomon	Ph.D, Mechanical Engineering, 1984	A	NTT	PT	30	15	2	N/A	L	H	N/A
Lianxiang Yang	PhD, Mechanical Engineering, 1997	P	T	FT	4	24	13	N/A	H	H	M
Xia Wang	Ph.D, Mechanical Engineering, 2003	ASC	T	FT	0	9	9	N/A	H	M	L
Qian Zou	Ph.D, Mechanical Design and Theory, 2001	ASC	T	FT	0	20	13	N/A	H	M	L

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
Fall 2013, Mechanical Engineering

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]	
Gary Barber	FT	ME 372, 4 credits, ME 474/ 574, 4 credits	40	40	20	100
Bhushan Bhatt	FT	ME 482/582, EGR 250, 4 credits	60	30	10	100
Yin-Ping Chang	FT	ME 421, 4 credits, EGR 120, 1 credit	40	40	20	100
Randy Gu	FT	ME 308, 4 credits, ME 487/587, 4 credits	40	40	20	100
Laila Guessous	FT	ME 331, 4 credits, ME 438/538, 4 credits	40	40	20	100
Ching Long Ko	FT	ME 562, 4 credits, ME 564, 4 credits	40	40	20	100
Chris Kobus	FT	ME 479/579, 4 credits,	30	30	40	100
Michael Latcha	FT	ME 492, 4 credits, ME 549, 4 credits	50	10	40	100
Keyu Li	FT	ME 322, 4 credits, ME 461/561, 4 credits	40	40	20	100
Zissimos Mourelatos	FT	ME 586, 4 credits	20	30	50, Chair	100
Sayed Nassar	FT	ME 489/589, 4 credits, ME 569, 4 credits	40	40	20, FAJRI	100
Brian Sangeorzan	FT	ME 456, 4 credits	40	30	30	100
James Schall	FT	ME 322, EGR 280, 4 credits	40	40	20	100
Xia Wang	FT	ME 536, 4 credits, EGR 250, 4 credits	40	40	20	100
Lianxiang Yang	FT	ME 467/567, 4 credits	40	40	20	100
Qian Zou	FT	ME 361, ME 475/575, 4 credits	40	40	20	100
Alexandros Alkidas	PT	ME 457/557, 4 credits	70	30		100
Turgay Bengisu	PT	ME 423/523, 4 credits	100			100
Rodrigue Narainen	PT	ME 571, 4 credits	30	70		100

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%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution.

Table 6-2. Faculty Workload Summary
Winter 2014, Mechanical Engineering

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]	
Gary Barber	FT	ME 372, 4 credits	20	40	40	100
Bhushan Bhatt	FT				Leave	100
Yin-Ping Chang	FT	ME 421, 4 credits, ME 530, 4 credits	40	40	20	100
Randy Gu	FT	ME 308, 4 credits, EGR 120, 1 credit	40	40	20	100
Laila Guessous	FT	ME 539, 4 credits, EGR 250, 4 credits	40	40	20	100
Ching Long Ko	FT	ME 521, 4 credits, ME 569, 4 credits	40	40	20	100
Chris Kobus	FT	ME 448/548, 4 cr., ME 454/554, 4 cr., ME 648, 4 cr.	30	30	40	100
Michael Latcha	FT	ME 486, 4 credits, ME 492, 4 credits	50	10	40	100
Keyu Li	FT	ME 322, 4 credits, ME 565, 4 credits	40	40	20	100
Zissimos Mourelatos	FT	ME 522, 4 credits	20	30	50, Chair	100
Sayed Nassar	FT		0	70	30, FAJRI	100
Brian Sangeorzan	FT	ME 331, 4 credits , ME 456, 4 credits	40	30	30	100
James Schall	FT	ME 443/543, 4 credits, EGR 280, 4 credits	40	40	20	100
Xia Wang	FT	ME 537, 4 credits, EGR 250, 4 credits	40	40	20	100
Lianxiang Yang	FT	ME 467/567, 4 credits, ME 665, 4 credits	40	40	20	100
Qian Zou	FT	ME 361@OU, 4 credits, ME361@MUC, 4 credits	40	40	20	100
Turgay Bengisu	FT	ME 526, 4 credits	100			100
William Edwards	PT	ME 473, 4 credits	60	20	20	100
Rodrigue Narainen	PT	ME 472/572, 4 credits, ME 678, 4 credits	50	50		100
Vijitawsha Pandey	PT	ME 595, 4 credits	20	80		100
Johann Pankau	PT	ME 484, 4 credits	100			100
Arun Solomon	PT	ME 555, 4 credits	100			100

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%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution.

CRITERION 7. FACILITIES

A. Offices, Classrooms and Laboratories

As a result of our assessment process during the 2004 to 2008 period, we determined that a new engineering center was necessary in order for us to continue to deliver high quality instruction for our undergraduate programs. From 2008 to 2011, we worked with school and university administrators as well as with our faculty and students (Table 7-1) to develop a plan for a new five-story, 125,000 sq. ft. Engineering Center (EC). On August 1, 2014, our School of Engineering and Computer Science (SECS) is scheduled to move into the EC. The EC will be the new home for the School of Engineering and Computer Science, featuring state-of-the-art classrooms and research space and will serve as the heart of the Engineering and Computer Science community at Oakland University.

Table 7-1: Student and Faculty Feedback shaping the new Engineering Center

Students and Faculty wanted…..	**We worked with architects to include….**
Charging stations for smart phones	Large number of conveniently located power outlets.
Convenience of enjoying lunch and refreshments in the EC	National food chain restaurant for bagels, drinks, and sandwiches.
Access to rooftop for renewable energy studies and for bio materials garden (for energy studies)	418 EC – Green Roof and Rooftop Lab: 5,601 sq. ft. (Features externally exposed heavy beam structures upon which solar panels, light wind turbines and similar pieces of equipment may be attached. Also features soil region for producing vegetation for studies.)
Access to real time data for EC electrical energy consumption and HVAC statistics.	With building facilities supervision, access points for real time electrical energy and HVAC data collection. This data may be used for research studies.
Updated and modern teaching labs and classrooms.	See Table 7-2 below.
More space exclusively designated for student organizations.	186 EC – Formula SAE Garage: 1,857 sq. ft. 261 EC – Stud Org Work Area: 1,000 sq. ft (approx.)
Showers to accommodate students who elect to jog or bike to campus	265 EC – Personal Health Room
More multi-purpose, open space. More study space. Space for tutoring.	Space for full vehicle displays, company sponsored demonstrations, and poster sessions. 102 EC – Student Project Display Area: 862 sq. ft. 196 EC – Pre Function Area: 729 sq. ft. 7 smaller study space areas on the first floor 271 EC – Student Collaboration Room: 909 sq. ft. 270 EC – SECS Tutoring Center: 269 sq. ft. 250 EC – 2nd Floor Informal Learning Area: 916 sq. ft. 196 EC – 1st Floor Group Proj. Study Area: 263 sq. ft. 257 EC – 2nd Floor Group Study Area A: 128 sq. ft

Students and Faculty wanted…..	We worked with architects to include….
	259 EC – 2nd Floor Group Study B Area: 128 sq. ft. 261 EC – 2nd Floor Group Study C Area: 128 sq. ft. 350 EC – 3rd Floor Informal Learning Area A: 67 sq. ft. 363 EC – 3rd Floor Inform Learning Area B: 144 sq. ft. 471 EC – 4th Floor Inform Learning Area A: 452 sq. ft TBD – 4th Floor Informal Learning Area: 137 sq. ft. 475 EC – 4th Floor Group Study Area B: 299 sq. ft. 547 EC – 5th Floor Group Study Area A: 299 sq. ft. 563 EC – 5th Floor Inform Learning Area A: 139 sq. ft. 575 EC – ISE Student Lounge: 303 sq. ft.

Offices

The ME department has an administrative suite with a reception area to greet students, faculty and visitors and an office for the department chair and the departmental secretary. There are about 18 faculty offices that are 130 square feet in size and contain phone and internet service. Each faculty office contains a computer, file cabinets, large desk area and shelving. There is also a network printer and photocopying machine for faculty. There is significant seating office space for teaching assistants, as they play a big role in assisting faculty, especially in our undergraduate courses that have labs associated with them.

Classrooms

All Oakland University General Purpose Classrooms are equipped with an enhanced level of instructional technologies. The following resources can be found in every classroom: chalkboard and/or whiteboard, a video projection system and display screen, a DVD and/or Blu-ray player, a classroom computer, an electronic flat panel display with annotation capabilities, a table-top document camera, a reinforcement sound system, and a user friendly electronic control system. Each classroom is equipped to allow wireless internet access (Grizznet).

Laboratory Facilities

The ME department has 12 teaching labs to support the BSE-ME program and one vehicle lab (to support the SAE team competitions), all of which are located in the new Engineering Center. These are listed below with the courses they support and a detailed list of equipment in each of these labs is contained in Appendix C.

- CAD Lab (EGR 120, ME 308, Student Teams)
- Circuits Lab (EGR 240)
- Sophomore Project Lab (EGR 280)
- Thermodynamics Lab (EGR 250)
- Mechanics of Materials Lab (ME 361, ME 461)
- Materials Science Lab (ME 372, ME 472)
- Fluid Mechanics and Heat Transfer Lab (ME 331, ME 438, ME 448)
- Energy Lab (ME 456, ME 457, ME 454)
- Tribology Lab (ME 475)

- Statics and Dynamics Lab (EGR 280, ME 322)
- Advanced CAD Simulation Lab (ME 438, ME 443, ME 487, ME 488)
- Senior Design Lab (ME 492)
- SAE Vehicle Lab (Student Teams)

Because the EC is dedicated primarily to teaching activity, SECS maintains about fifty rooms/labs for primarily research activity in Dodge Hall of Engineering (DHE) and the Science and Engineering Building (SEB). With access to the space in DHE and SEB and to the faculty who work there, our undergraduate students enjoy many opportunities to enrich their education through research collaboration with our faculty. Some of the many laboratories in DHE and SEB that are accessible to our undergraduate students are listed below:

- Fastening and Joining Research Institute Lab (8 rooms)
- Micro-Electro-Mechanical (MEMS) Lab
- Chrysler Robotics Lab
- Fuel Cells Lab
- Electric Vehicle Power Supply Lab
- Experimental Stress Analysis Lab
- Engine Dynamometer Lab
- Powertrain Thermal Analysis Lab
- Optical Inspection Lab (Research and ME 467)
- Hardware in the Loop Lab
- Design Under Uncertainty Lab
- Mixed Mode Microprocessorless Lab
- Biomedical and Biomimetic Systems Lab
- Embedded Systems Research Lab

Additional labs in SEB and DHE are also available. Due to the transition into the new building, many of these labs, however, were renovated and/or reassigned to a different location during the spring/summer 2014 period. Accordingly, a precise prescription of their location is not included herein because the information was not known at the time of the preparation of this report.

Table 7-2 provides an overview of all the labs and classroom in the new building. Space for our Computer Science (CS) and for our Information Technology (IT) programs is also included because all of the space listed is open to all of our undergraduate students; the entry in the program column, therefore, should not be interpreted as the only program served in the associated space. M.E., E.E., C.E., and I.S.E. denote Mechanical Engineering, Electrical Engineering, Computer Engineering, and Industrial and Systems Engineering, respectively.

Table 7-2: Labs and Classrooms in the new Engineering Center

ROOM #	NAME	No. of Seats	SQ. FT	PROGRAM
182 EC	Mechatronics and Controls Lab	20	1,281	EE and CE
178 EC	Senior Project Lab	84	3,051	ME, EE, CE, ISE
177,179,185 EC	Machine Shop and Wood Shop		3,574	All
170 EC	Sophomore Design	40	1,245	
116 EC	Lecture Hall	200	4,450	University wide
281 EC	Classroom A	50	1,353	University wide
279 EC	Classroom B	50	1,313	University wide
275 EC	Classroom C	50	1,350	University wide
268 EC	Clean Room		885	EE, CE
264 EC	Characterization Lab	8	493	EE, CE
260D EC	Small Microscopes Lab	6	397	ME
260 A,B,C EC	XPS/SEM/TEM Lab	4	402	
254 EC	Classroom D	100	2,082	University wide
370 EC	Energy Lab	12	1,195	ME
366 EC	Bioengineering Dry Lab	12	569	ME
364 EC	Bioengineering Wet Lab	12	889	ME
360 EC	Fluids Lab	24	1,189	ME
356 EC	Thermo Lab	32	595	ME
357 EC	Introductory Robotics Lab	4	906	ME, EE, CE
470 EC	Tribology Lab	14	889	ME
468 EC	Materials Lab	12	889	ME
466 EC	CAD Lab	45	887	ME, EE, CE
464 EC	Statics and Dynamics Lab	16	587	ME
460 EC	App. Reconfigurable & Embedded Sys. Lab	20	588	EE, CE
458 EC	ECE General Lab	12	588	EE, CE
454 EC	Mechanics of Materials Lab	12	588	ME
452 EC	Sheet Metal Forming Lab	12	588	ME
450 EC	Power and Machines Lab	36	947	EE, CE
455 EC	Electronics Lab	16	594	EE
457 EC	Communications Lab	16	590	EE
461 EC	Adv. CAD Simulation Lab	12	599	ME
570 EC	S&R Sharf Computer Integrated Manu. Lab	5	889	ISE
568 EC	Product Lifecycle Management	32	588	ISE
566 EC	Computing Lab III	24	588	CS & IT
562 EC	Computer Engineering Lab	24	587	CE
560 EC	Computer Engineering Lab I	32	887	CE
556 EC	Circuits Lab	24	889	EE
554 EC	Networking and Security Lab	54	1,181	CS & IT
550 EC	Computing Lab I	38	947	CS & IT
555 EC	Computing Lab II	24	598	CS & IT
557 EC	HCI Visual Computing Lab	8	902	EE

B. Computing Resources

University-wide Computing Resources

The University Technology Services (UTS) department provides basic computing services to all Oakland University students on the main campus as well as on the Anton Frankel and Macomb University Center campuses. This includes email, files sharing, E-learning (through Moodle), and the Google apps suite. UTS provides and manages internet access through wireless networking in almost every building on campus. Through the services of the Classroom Support and Instructional Technical Services (CSITS) office, physical access to general purpose computing labs is available at various locations on campus. These locations include the following:

- Main Campus - Oakland Center For most of the year students and faculty have access from Monday through Friday from 7:00 AM to 9:00 PM, and on Saturday from 8:00 AM to 5:00 PM.
- Kresge Library - open 24 hours per day, seven days a week.
- Residence halls – Open from 7 AM to midnight, seven days a week.
- Macomb University Center – For the fall and winter, computer labs are accessible from 8:00 AM to 9:00 PM for Monday through Thursday; for Friday, access ends at 5:00 PM. For the summer, computer labs are accessible from 8:00 AM to 6:00 PM for Monday through Thursday; for Friday, access ends at 5:00 PM.
- Anton Frankel Center – For the fall and winter, computer labs are accessible from7:00 AM to 9:00 PM for each of the five week days. For the summer computer labs are accessible from 7:00 AM to 5:00 PM for each of the five week days.

For unique needs, all university students have access to the Student Technology Center which provides personal instruction, group classes, and equipment loans for digital cameras, laptops, and video cameras. All faculty and staff have access to all of the services described above via their own personal university-provided computers, however they also have full access to the resources made available to the students as well. Finally, through e-Learning and the Instructional Support unit of the institutional computing infrastructure, students, staff, and faculty have access to courseware and technical support for the creation of online learning material and development of web solutions for academic needs.

Within the School of Engineering and Computer Science: Prior to Fall 2014

An additional set of technology services has also been provided by the School of Engineering and Computer Science for students and faculty of the school. These services include, but are not limited to:

- Custom virtual machine creation
    - Allows students and staff to gain hands on experience administering their own servers, or utilize a custom lab environment
- Web Hosting
    - Students and staff can build their own websites using various file types
- General purpose Linux server access

    - Two (2) Scientific Linux servers
    - Three (3) Ubuntu servers
- Free software distribution
    - Microsoft Developer Network Academic Alliance (MSDNAA)
    - VMware Academic Program (VMAP)
- Version Control
- Database access
- Compute Cluster
    - Uses Rocks cluster software with access to 64 cores
- Remote access to SECS resources
    - Provided through a VPN
- GPU server
    - Scientific Linux server with 3 NVidia Tesla GPUs
    - Runs Cuda Software
- Network Storage
    - Access to the H:\ Drive
- Remote Desktop Services Server

Computing Facilities:

In addition to the aforementioned resources described in the previous section, SECS also has access to the following computing resources labs:

Mechanical Engineering Program

- Room 144 DHE. This room is primarily dedicated to CAD and CAE activity. (Room capacity: 34)

Electrical and Computer Engineering Program

- Room 147 DHE. This room is primarily dedicated as a general computer lab and instructional space (Room capacity: 17)
- Room 116 SEB. This room is primarily dedicated to Automotive Mechatronics (Room capacity: 14)
- Room 129 SEB. This room is primarily dedicated to Circuit Design (Room capacity: 16)
- Room 133 SEB. This room is primarily dedicated to a general computer lab and instructional space (Room capacity: 22)

Computer Science Program

- Room 167 DHE. This room is primarily a general computer lab and instructional space (Room capacity: 36)
- Room 113 HHS. This room is primarily a general computer lab and instructional space (Room capacity: 36)
- Room 123 HHS. This room is primarily a general computer lab and instructional space (Room capacity: 18)

- Room 205 DHE. This room is primarily a networking and security lab and instructional space (Room capacity: 32)

Industrial and Systems Engineering

- Room 657 SEB. This room is primarily a general computer lab and instructional space (Room capacity: 14)

Hours of Operation:
The majority of our labs are available to students at all hours of the days, provided that they have the key code for that room. Key codes can be obtained from the students' professor or from the departmental secretaries. Students must be currently taking a course in order to get a key code. Five general purpose Linux servers are available to students twenty-four hours a day via SSH. With a wired connection on campus, nothing other than a Linux terminal or emulator is needed to connect to the servers. Through the Wi-Fi on campus, and from off of campus, our Aventail VPN must be used to be able to connect. The client is readily available for free download to the students through the CTO website. A web method of VPN connection is also available at remote.secs.oakland.edu.

Within the School of Engineering and Computer Science: Starting Fall 2014

Table 7-3: Computing labs in the new Engineering Center

EC Room	Primary Purpose	Dept	# of Computers	Availability
554	Computing Lab	CSE	24	M-F 8-5
461	Computer Aided Drafting	ECE	13	M-F 8-5
182	Computing Lab	ECE	6	7x24x7
178	Project Space	ME	14	7x24x7
170	Project Space	ECE	10	7x24x7
450	Computing Lab	ECE	12	M-F 8-5
455	Computing Lab	ECE	24	7x24x7
464	Computing Lab	ECE	8	M-F 8-5
556	Computing Lab	ECE	13	7x24x7
457	Computing Lab	ECE	8	7x24x7
364	Computing Lab	ECE	6	M-F 8-5
357	Robotics Lab	CSE	6	M-F 8-5
568	Product Lifecycle Management	ISE	18	M-F 8-5
566	Computing Lab	CSE	24	M-F 8-5
562	Computing Lab	CSE	24	7x24x7
550	Computing Lab	CSE	40	7x24x7
560	Computing Lab	ECE	32	7x24x7
555	Computing Lab	ECE	24	7x24x7
554	Networking and Security Lab	CSE	54	M-F 8-5
466	Computer Aided Drafting	ME	46	7x24x7
452	Research	ECE	8	M-F 8-5

At the time of the preparation of this report, some of the details about the exact schedule for room availability were not solidified. Consequently, a precise statement about the computing resource accessibility beginning in fall 2014 is not included herein. Our practices for managing the new building computing resources, however, are essentially going to be the same as those carried out when we occupied the old buildings. In Section 7.A above, a list of the labs with computing resources is provided. The introduction of the new building computing resources in conjunction with its student friendly accommodations represents a significant step forward in our ability to provide the best available computing resources to our students. Therefore, our ability to support both students and faculty in their educational, scholarly and professional activities is excellent.

C. Guidance

Guidance for our students' use of tools, equipment, computing resources, and laboratories conforms to those guidelines put forth by the Oakland University Office of Environmental Health and Safety (EH&S) and the OU Information Technology (IT) Office.

For students using hand tools and machine tools in laboratories, such as the *SAE Vehicle Lab*, or the *Mechatronics and Controls Lab,* safety policies are governed by the EH&S Office. For our students who need guidance with respect to activities in Student Design, computing and other labs, the same basic policies still apply. They are:

1. Report Problems
2. Seek Authorization
3. Engage in school-related activities
4. Obtain Training
5. Promote Security

For students using hand tools and machine tools in laboratories, such as the *SAE Vehicle Lab*, or the *Mechatronics and Controls Lab,* the Vehicle Engineering Lab (VEL) policies apply: (Extracted from documentation from the EH&S office.)

General Requirements
These Vehicle Engineering Lab (VEL) use requirements have been written to establish the safe use of the Vehicle Engineering Lab (VEL).

Users of the VEL will only be authorized access to the facility upon the completion of documented training described below and approval by the VEL Coordinator (currently Matt Bruer). The VEL garage is a place for student engineers to learn hands on skills and should not be considered a club house or place to "hangout" between classes. Student organizations are expected to behave professionally and must coexist in a business-like manner with the other Occupants of the Police and Public Services Building. The VEL is property of Oakland University therefore any modifications to the facility must be made through a request to the VEL

Committee. *Note: Any structural modifications (plumbing, electrical or carpentry) to the VEL facility must be approved by SECS Deans Office and Facilities Management.* The VEL must be maintained in accordance with University Policy and all applicable codes, standards, and regulations. VEL users will read the “Vehicle Engineering Lab Use Requirements” and sign the “Acceptance of VEL use Requirements” indicating that they will abide by the requirements specified below.

Compliance:

1. Reporting Violations:
    a. Any violation of the VEL Use Requirements or safety concern shall be reported to the VEL Coordinator by email.
    b. Safety spot checks will be conducted by VEL Coordinator, Faculty Supervisors, and EH&S.
    c. VEL Organization Safety Coordinators will conduct a self-audit of their area by the 2nd week of the semester and report their findings to the VEL Coordinator, Faculty Supervisor and the Laboratory Compliance Manager.
2. Any violation of these VEL Use Requirements may result in immediate suspension of privileges to the VEL.

Oversight:

1. VEL Coordinator (SECS Lab Manager or Asst. Lab Manager):
    a. Will enforce the allowable use of the VEL, (structural modification requests, designated space modifications, requests for space use, MSDS binder maintenance, etc.) in accordance with University Policy.
    b. Will be responsible for authorizing access to approved VEL facility users who have met the criteria (Attachment B) for access to the VEL.
2. VEL Tools Coordinator (Project Engineer-SECS):
    a. Will inspect machine shop equipment guarding, SOP’s, and postings at the beginning of Fall, Winter, Spring and Summer Semester.
    b. Will authorize use of Machine Shop Equipment and Power tools.
    c. Will train users on the safe use of Machine Shop Equipment and Power tools. Training must be documented by a sign in log.
    d. Will authorize welders who have documented hands on experience with welding and completed a welding training/quiz.
3. Student Organization Use: By the second week of each semester each student organization will identify the following:
    a. Faculty Supervisor: Will be responsible for the advising the student organization on safe use of the facility and helping to maintain continuity of safety practices and programs throughout the academic year.
    b. Organization Head : Student leader (Example: SAE President) responsible for insuring student organization follows the VEL use requirements and meets conditions for authorized entry to VEL.

c. Organization Safety Coordinator:
   i. Will provide or arrange specific safety training on equipment used by the organization.
   ii. Will work with other coordinators to make sure VEL equipment is in safe working order.
   iii. Will arrange for required training for new members.
   iv. Will conduct safety audit by the 2nd week of each academic semester.
   v. Will update MSDS sheets available in VEL lab binder for all hazardous chemicals used by student organization.
d. Organization Hazardous Waste Coordinator:
   i. Will be responsible for safely collecting and storing hazardous or recyclable waste in a designated VEL area.
   ii. Contacting EH&S for appropriate disposal of waste.
   iii. Must complete EH&S Hazardous Waste Management training.
   iv. Must train lab occupants on Hazardous Waste management procedures specific to their operation.
e. Once the above organizational members have been identified a contact list, with email, cellphone must be forwarded to the VEL Coordinator, EH&S and the University Police.

Training:
Authorized users of the VEL are required to complete the appropriate training listed below. Anyone found working in the VEL operating equipment, tools or chemicals without documented training will be asked to suspend work and leave the VEL.

1. Required Training for all VEL Users:
   a. VEL Requirements Overview / General Shop Safety: Provided by EH&S. All users must read and sign Attachment A of these requirements.
   b. Laboratory Right to Know Training: Provided by EH&S. Covers the Chemical Hygiene Plan and Right to Know training.
   c. Power Lock Out Tag Out/Machine Guarding/Hand & Power Tools Training: Provided by EH&S.
   d. Demonstrated Proficiency in Safe Use of General Machine Shop Equipment and Power Tools: Provided by VEL Tools Coordinator
2. Required Training for Mill and Lathe Operator:
   a. Demonstrated Proficiency in Mill and Lathe Operation: Provided by VEL Tools Coordinator
3. Required Training for Hazardous Waste Coordinator
   a. Hazardous Materials Training: Provided by EH&S. Organization Hazardous Waste Coordinator must complete this training.
4. Required Training for Welder/Hot Work

a. Welding Safety/Hot Work: Provided by EH&S. All personnel conducting hot work (grinding, torch cutting, welding)
b. Welding Proficiency: Provided by VEL Tools Coordinator. Trainee must demonstrate welding proficiency and provide documentation of experience and training.

5. Training Continuity: The membership of the various SECS student organizations using the VEL changes from semester to semester. To ensure a smooth transition and to prevent suspension of work, it is incumbent on the Faculty Supervisor and the Organization Head to promptly arrange training for new members.

Access and Security:
Access and Security to the VEL must be maintained 24/7. The facility is not to be left unlocked when unoccupied. Work access within the facility is limited to VEL authorized entrants or Oakland University support staff.

1. Facility Key control:
   a. The Organization Head will provide a list of students who have completed required training to the VEL Coordinator. This list will be network accessible to the VEL Coordinator, VEL Tools Coordinator, Faculty Supervisor and EH&S.
   b. VEL Coordinator will approve the issuance of a key if requirements in attachment B have been met.
   c. Organization Head will update organization roster list each semester.
   d. Keys for terminated members must be returned to the SECS Dean's Office.
   e. Lost keys must be reported to the Organization Head.
   f. Keys may only be issued to an approved VEL facility user and must not be loaned to other members.

2. Equipment Key Control: The VEL Tool Coordinator will restrict the use of equipment requiring specific training by the use of a keyed lock. Any equipment key issued by the VEL Tool Coordinator may only be used by the person assigned to the key. Keys may not be loaned to anyone.
3. Power Lock Out Key: (Energy control procedures are documented in the Oakland University Energy Control Procedures Manual.

Safety Implementation:
If work cannot be done safely then the work may not proceed. The following are guidelines for implementing safety work:

1. Purchasing Safety Materials and Services:
   a. The Organization Head will arrange for the purchase of safety equipment or supplies (such as signage, safety tape or markings, safety glasses, etc.) required for organization's safe operation in the VEL.

b. Organization Head or Organization Safety Coordinator will coordinate service requests by reporting them to the VEL Coordinator by email (Examples: repairing safety showers, exhaust hoses, exhaust fan, replacing fire extinguishers, etc.,)

Formal Training Courses:

Our students also have access to formal training for a wide array of topics. A list of the training courses, which are offered by the EH&S office is provided below:

- Aerial Work Platform - Type 1 (Bucket Truck)
- Aerial Work Platform - Type 2 (Personnel Lift)
- Asbestos Awareness
- Bloodborne Pathogens Exposure Control
- Confined Spaces Training
- EVAC the RAC
- Fire Extinguisher Training
- FMLA Supervisor Training
- Hazardous Waste Management
- Infection Prevention and Control
- Michigan Right-to-Know (Hazard Communication) .
- Power Lockout/Tagout
- Respirator Usage
- Wellness and Injury Prevention Health Fair

For students who may need occasional use of hand tools, such as students in the EGR 280 (sophomore design) or the Senior Design courses, the same basic policies apply. They are:

1. Report Problems
2. Seek Authorization
3. Engage in school-related activities
4. Obtain Training, if needed
5. Promote Security

Students who require only an occasional use of simple hand tools, may seek approval to do so through the Laboratory Manager (currently Matt Bruer), and/or the University Engineer (currently Peter Taylor). Students must demonstrate competence, use appropriate safety gear (*i.e.,* safety glasses) and keep their work place clean. Failure to abide by the policies will result in loss of privileges.

OU's IT (Computing) Policy

Use of university-owned computers, or use of university-provided internet services are governed by OU's IT Policy, which is available on the OU website and also displayed (via links) at time of logon. In order to logon to a university computer, or to use the university-provided internet service (Grizznet), each student must have a university ID and password. Each machine (university or personal) must be registered once per year to gain access. A summary of the OU IT Policy is provided online, as well as a full policy statement. The summary policy is as follows:

> Your access to university resources comes with responsibilities. To keep our network safe, OU maintains a detailed computing policy that you must follow. The following top 10 list provides only the highlights. For more information, refer to the full policy.
>
> 1. *Sharing and downloading movies, music, games and software that you don't own and/or without permission of the owner is a violation of university policy as well as copyright and federal law.*
> 2. *Important OU information will only be delivered to your OU email account.*
> 3. *Using email or any IT tool to harass, intimidate or bother someone is not acceptable. If someone asks you to stop, you must comply.*
> 4. *You are responsible for maintaining your computer. That means you must install anti-virus software, maintain system patches and use appropriate system protection like a firewall.*
> 5. *Limited game playing on university computers is OK as long as it does not disrupt or limit resources for others.*
> 6. *Sharing your IDs and passwords is not a good idea; you are responsible for what happens from your account. Sharing also puts you at risk of identity theft.*
> 7. *Using the Internet for research can be useful, but copying material from websites without properly citing your sources is plagiarism. As you surf for information, keep track of the sites you visit so you can properly cite the sources in your assignment.*
> 8. *Political campaigns, commercial advertising campaigns and personal businesses cannot be run using university computing resources.*
> 9. *You must have prior approval to install wireless network devices in your campus residence.*
> 10. *Breaking the rules can result in a variety of consequences, depending on the offense. Consequences may include disconnection from the network or referral to the dean of students for appropriate judicial processing.*
>
> *Remember, it is your responsibility to understand and follow the entire IT policy.*

D. Maintenance and Upgrading of Facilities

Laboratory tools, equipment and computing resources, hereafter called "machines", are the property of the university. Most of our machines fall under one of two classifications: faculty-managed or department-managed.

Faculty-Managed

Faculty-managed machines are typically purchased through the use of faculty grant funds. Although many of the faculty-managed machines are used exclusively by a single faculty member, they are accessible to all faculty, in principle. If students are properly trained and if the faculty member agrees, then students also can have controlled and supervised access to the faculty-managed machines. There is no set policy on how or when faculty-managed machines are updated, however when machine upgrades become necessary to maintain the integrity of the student and/or faculty research, funding from additional grants is sought.

Department-Managed

Department-managed machines are typically purchased through the use of school or university funds. These department-managed machines are used almost exclusively by students within the context of their course work. Faculty instructors monitor the performance of their machines through regular inspection. This process is not typically a formal one. Rather, it is one for which the professor makes regular observations as part of his/her supervision of the students' work. There is no set policy on how or when department-managed machines are updated, however when machine upgrades become necessary to maintain the integrity of the students' course work, funding from the school or university is sought.

Policies and Procedures for Laboratories

Upgrading and maintenance of laboratory furniture, physical structure is handled similarly to that for department-managed machines. For concerns that are associated with safety, or concerns that present obstacles to the teaching process, the university quickly provides a solution at its expense. Initial notification of these laboratory concerns, usually involves an email notification to our laboratory manager, who relays the message to the university facilities office.

E. Library Services

Building Facilities and Hours

Oakland University's Kresge Library is centrally located on the Oakland University campus, within a short walk from all classroom buildings, the student services building and the university's student center. During the fall, winter, and most of the summer term, the library is open 24 hours per day, seven days a week. The library provides seating for 1,700 users in the form of study carrels, individual and group study rooms, open tables and other seating, as well as a café near the entrance.

Computing Facilities

Oakland University Library provides student-oriented technology and computing facilities in several ways. First, the Learning Commons encompasses the main floor and offers students group meeting areas and study spaces in which to work, and services (such as Technology Help and Research Help) to enhance their research and learning. In this collaborative work space, the library provides cabanas with technology set-ups designed to share information, whiteboards for in-library use, color and black-and-white printers, scanners, and copiers. Throughout this space, there are approximately 156 computer workstations (both PC and Apple); all computers in the Learning Commons are loaded with the Microsoft Office suite, the Adobe Acrobat Reader and Web browsers. SPSS, Second Life, and various media player packages are also available on certain machines.

The library maintains two instructional computer labs for library instruction; each lab contains an instructor’s workstation equipped with Vision classroom control software, 25 student workstations, a printer, and a document projector. A third room is equipped with an instructor’s workstation and projector, a document projector, and seating for approximately 40 students.

Circulation and Interlibrary Loan Services
Undergraduates may check out most library materials for three weeks; graduate students and faculty are allowed longer borrowing periods (eight weeks and fifteen weeks, respectively).

Students and faculty may request, at no charge, materials not held by our library through ILLiad, the library’s online interlibrary loan (ILL) system; direct links from the library’s databases to ILLiad enable patrons to request materials seamlessly. Most materials requested through ILL are available within a few days. In addition, the library participates in MeLCat, a statewide catalog of many of Michigan's libraries, which enables patron-initiated requests for books at other Michigan libraries. Members of the faculty also have borrowing privileges at all state-supported colleges and universities within Michigan.

Research Assistance and Instruction Services
Research assistance – in person, and by phone, e-mail and Instant Messaging (IM) chat – is provided by librarians for almost all of the hours that the building is open. In addition, an online guide to the library’s engineering and computer sciences library resources is frequently updated with new content.

In 2012-2013, library faculty conducted 349 course-related instruction sessions and workshops, including 128 sections of Writing 160, Oakland’s first-year writing course. In addition, library faculty provided 349 individual research consultations to Oakland students and faculty.

Library Collection Development
Librarians are assigned as liaisons to each department/academic unit on campus to promote communication between the library and its users. The librarian liaisons inform faculty about the library's holdings and services, gather information about needs and concerns, and work with the unit to develop the library’s collections.

Academic departments are allocated funds to request books in their subject area for the library’s collection. In addition, interest income from the Critchfield bequest is used to support the library’s subscription to the *ACM Digital Library* and other electronic resources. Library expenditures specifically for engineering and computer science materials are included in Table 7-4. It is important to note, however, that these expenditures do not include the library’s subscriptions to many of its major journal packages, such as the *ScienceDirect Freedom Collection* from Elsevier Press, that serve many disciplines at the university.

Engineering/Computer Science Resources
The OU Libraries currently provide access to more than 4,800 e-journals and 22,000 eBooks in engineering and computer science; a list of the major engineering and computer science research tools available to Oakland students and faculty is included in Tables 7-5, 7-6, and 7-7. All

electronic resources are available through the library’s website and from off-campus through its proxy server.

Table 7-4: Engineering and Computer Science Library Expenditures, FY09-FY14

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14[3]
Books						
print[1]	$ 4,234.40	$ 779.46	$ 3,566.09	$ 583.64	$ 361.91	$ 3,800.00
online	$ 2,849.99	$ 3,528.70	$ 14,779.94	$ 16,276.00	$ 5,640.00	$ 11,700.00
Serials						
print[1]	$ 23,960.37	$ 20,098.61	$ 8,304.60	$ 5,488.04	$ 5,805.32	$ 5,643.00
online	$ 115,505.00	$ 113,887.87	$ 137,029.40	$ 146,568.10	$ 151,496.37	$ 157,354.31
Databases and other online resources	$ 11,446.00	$ 12,190.00	$ 27,982.00	$ 29,276.00	$ 30,432.00	$ 32,000.00
Total for Engineering Resources[2]	$ 157,995.76	$ 150,484.64	$ 191,662.03	$ 198,191.78	$ 193,735.60	$ 210,497.31
Total Library Collection Expenditures	$ 2,183,466	$ 2,110,952	$ 2,338,918	$ 2,493,809	$ 2,563,855	$ 2,817,900

[1]Expenditures for print resources have decreased as the library has converted most of its engineering journal subscriptions to electronic format.

[2]These figures do not reflect library expenditures for online resources such as *Web of Science,* Elsevier's *ScienceDirect Freedom Collection*, the WileyBlackwell journal package, the Springer Verlag journal package and eBook collections (which includes *Lecture Notes in Computer Science*), and other multi-disciplinary resources. These resources are heavily used both by SECS faculty and students and by faculty and students from other departments. Therefore, none of these expenditures are included in this table.

[3]Estimated

Table 7-5: Major eBook Collections

Major eBook Collections	
IEEE/Wiley	more than 550 ebooks, 1974-present
IET	recent publications from the IET
Safari eBooks	100 books covering computer science and information technology
Springer	over 15,000 eBooks and book series in engineering & computer science, including Lecture Notes in Computer Science, 2005-present
Synthesis Digital Library	350 eBooks covering biomedical engineering, communication networks, computer architecture and more

Table 7-6: Journal Publisher Collections

Journal Publisher Collections	
ACM Digital Library	Complete full-text library of ACM journals, transactions and proceedings, from their first volume to present.
ASME Journals	19 titles, 2000-present
IEEE Xplore	IEEE transactions, journals, magazine and standards since 1998.
Sage Materials Science	15 materials science journals from Sage Publishers
ScienceDirect Freedom Collection	More than 1,800 journals published by Elsevier; subject coverage includes engineering, computer science and materials science.
Springer-Verlag	1,450 journals, primarily in the sciences
Wiley-Blackwell	More than 300 journals in engineering, materials science and computer science.

Table 7-7: Indexes and other Major Reference Sources

Indexes and other Major Reference Sources	
Applied Science & Technology Abstracts	Index of science and technology journals and magazines, 1983-present
Computer Database	Full-text database of computer-related news and trade periodicals, 1980-present
Computing Reviews	Reviews of books and articles in computer science
General Science Abstracts	Index of science and engineering journals, 1984-present
Engineering Village (Compendex)	Index of engineering literature, 1969-present
McGraw-Hill Encyclopedia of Science and Technology	Online version of the encyclopedia
SAE Digital Library	Technical papers from the Society of Automotive Engineers, 1998-present
SCOPUS	The largest abstract and citation database of peer-reviewed research literature with more than 20,500 titles from more than 5,000 international publishers.
Web of Science	Online version of the Science Citation Index includes citations and abstracts to articles from over 5,700 journals in the sciences and engineering since 1980

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

Overall Comments on Facilities

Overall, our facilities are adequate and safe for use by our faculty, staff, and students. We have two concerns, however. One is on the topic of Enrollment Growth, while the other is one the topic of Research Experience.

Enrollment Growth

Our programs have enjoyed prodigious enrollment growth over the past five years. With America's growing interest in advanced manufacturing, cyber security, big data management, next-generation computer systems, fuel economy, renewable energy, military defense solutions, and solutions for reducing health care costs, we are anticipating the continuation of a very strong demand for our students. To satisfy this demand, the SECS is expected to continue to grow. Therefore, we are concerned about our future ability to maintain the high quality instruction we have been able to deliver in the past. Specifically, we need to maintain or reduce our student-to-teacher ratio. To this end, we hope to receive support from our provost's office for additional full-time, tenure-track faculty positions. Additionally, the growth in students and faculty will necessitate increases in support staff, especially laboratory staff and computer and network support staff. While we will enjoy the increased lab space and modern new equipment in the new Engineering Center, it will take additional staff to maintain the labs and the equipment and ensure the safety of the students. We will need laboratory staff to maintain equipment and to work with students in design labs, especially as they use some of the newer tools, such as the 3-D printer and the SEM-Scanning Electron Microscope. We will need additional machine shop staff to support sophomore and senior design, and to train students in the use of machine tools, and to oversee students involved in student design competitions, such as the Formula SAE.

Research Experience

We are very proud of our research programs, in part, because we have been able to give our undergraduate students the opportunity to work directly with professors and graduate students in our research labs. Our full-time graduate student enrollment growth and our research laboratory space growth are significantly less than that of our undergraduate student enrollment. Consequently, it is becoming increasingly difficult for us to engage our undergraduate students in a research setting, a setting that plays a significant role in retention and academic performance. To circumvent this limitation, SECS is in need of support for a new research building. The SECS dean is aware of this concern and is very interested in continuing to provide our undergraduate students with opportunities to engage in meaningful research. Again, additional computer technology and laboratory support staff are of course also necessary to continue to provide an undergraduate research experience and to allow growth in graduate research.

Overall Campus and Laboratory Safety

Campus safety is enhanced by a full-time Campus Police (OUPD) and by the Office Environmental Health and Safety (EH&S).

OUPD – OU has a full-time police force that provides and oversees campus safety, emergency preparedness, community education and training in selected areas such as *Rape and Aggression Defense* and emergency procedures. Fire and EMS services are provided under through mutual aid agreements with the Auburn Hills and the Rochester Hills Fire Departments.

Office of Environmental Health and Safety - The mission of the EH&S office is to provide the campus community with resources and assistance in the areas of:

- occupational safety and health
- construction safety and health
- fire and life safety
- environmental protection
- regulatory compliance

In addition, EH&S offers training and consultation in many areas of safety, health, environmental protection and compliance. EH&S is responsible for safety training, as discussed in Criterion 7.C., and manages laboratory chemical inventories, MSDS and laboratory hazardous waste.

CRITERION 8. INSTITUTIONAL SUPPORT

A. Leadership

The leadership for the Mechanical Engineering Program is the department chairperson who works in close consultation with the Mechanical Engineering Undergraduate Affairs Committee (MEUAC). This committee comprises approximately five faculty members, including the department chair who serves in an ex-officio capacity. To help insure continuity and clear communication within the Mechanical Engineering Department, annual appointments are made for seats on the MEUAC. On an on-going basis, the department chairperson reviews and acts upon feedback on the program activity from students, faculty, and staff.

The quality of the program is maintained by a process that includes data collection, subsequent discussions, and corresponding actions at three organization levels: Department, School, and University. Commentary for each of these levels is provided below:

a. DEPARTMENT: Discussions at the department level are carried out at regular department meetings. Minor changes to the program are managed at the department level. For major changes, motions are articulated for subsequent, formal review. These motions brought before the school-level Undergraduate Curriculum Committee (UGCC) on which the chair of the MEUAC is a member.
b. SCHOOL: The UGCC discusses the motions and then submits them to the faculty assembly after it has been placed on the assembly meeting agenda. At the assembly meeting, the merits and weaknesses of the proposed motions are discuss. If the motion is deemed to contribute to the increase in quality of the Mechanical Engineering program, then it will be formally adopted by vote.
c. UNIVERSITY: Motions that have been passed by the SECS assembly are submitted to our university senate via a senate subcommittee. Most of the SECS motions receive formal and final approval at the senate level.

Throughout this entire process, the leadership of the Mechanical Engineering program, the chair of the Department of Mechanical Engineering, works in very close consultation with his/her colleagues to help ensure that the program quality is maintained and that all stakeholders have an opportunity to participate in the decision making process.

B. Program Budget and Financial Support

1. **Budget Process**: Although the decision-making for the Mechanical Engineering program annual budget is prescribed at the school level, it is informed by feedback from the faculty and staff in the Department of Mechanical Engineering. As shown in Table 8-1, the program expenditures are partitioned into six categories. Funding is secured through university general funds (state support and tuition), gifts, and grants. To demonstrate evidence for continuity of institutional support, academic years 2011-2012, 2012-2013,

and 2013-2014 (projected) are shown. Because some students elect to take a few selected courses outside of their home department, the financial statements for the ME department is provided below.

Table 8-1 Mechanical Engineering Budget

Operations: (not including staff)		**2012**		**2013**		**2014**
	Institutional Funds	68,785		65,165		44,919
	Grants and Gifts	2,063,441		1,921,393		1,607,591
	Discretionary Funds	43,730		19,676		17,811
Travel:						
	Institutional Funds	23,862		16,493		15,954
	Grants and Gifts	81,665		36,849		30,084
	Discretionary Funds	4,887		2,022		0
Equipment:						
	Institutional Funds	4,379		4,170		0
	Grants and Gifts	217,508		237,698		224,157
	Discretionary Funds	0		0		5,200
		0		0		0
Graduate Teaching Assistants:						
	Institutional Funds	125,037		110,631		118,507
	Grants and Gifts	0		0		0
	Discretionary Funds	0		0		0
Part-Time Assistance:						
	Institutional Funds	27,160		42,071		28,500
	Grants and Gifts	0		24,096		0
	Discretionary Funds	0		0		0
Faculty Salaries:						
	Institutional Funds	1,833,713		1,873,534		1,841,518
	Grants and Gifts	328,257		310,466		302,309
	Discretionary Funds	1,072		0		4,498
Total Fund Expenditures		4,823,494		4,664,265		4,241,047

2. **Teaching Support**: Teaching is supported through four main mechanisms. The first is that of the work-load policy which, in accordance with the SECS constitution and the collective bargaining agreement, allows for 40% of the faculty's time to be devoted to teaching responsibilities; this scenario helps SECS direct the amount of attention toward teaching that is necessary for high quality instruction and mentoring. The second mechanism is our SECS Graduate Assistantship (GA) program, which is designed to assign fully-supported graduate students to teaching assistant roles. The GA program has

been instrumental in helping the faculty manage grading responsibilities and multiple laboratory sections, thereby allowing them to devote more of their attention to mentoring students and development of course notes. The third mechanism is the encouragement of the faculty to connect with the university Center for Excellence in Teaching and Learning (CETL). Through CETL, faculty gain exposure to new pedagogical practices, mostly, through direct interaction with other faculty members. The fourth mechanism is the distribution of funds for travel to conferences at which the faculty can engage in professional development activities.

3. **Providing Resources for Acquisitions, Maintenance, and Upgrades**: The funding allocation process for acquisitions, maintenance, and/or upgrades is based upon feedback from faculty, staff, and students. For lower-cost software upgrades, faculty and staff submit requests directly to the SECS Computer Technology Office (CTO); these requests are often verbal and informal. For higher-cost requests, faculty and staff have the opportunity to request support from the dean's discretionary funds, competitive, internal funding programs, and/or university end-of-year surplus funds from the provost's office. Students also have the opportunity to affect the landscape of the teaching resources through their end-of-course comments and/or informal communications with the faculty and administrators. For most of these funding requests, answers are typically provided within a few days of the receipt of the request.

4. **Adequacy of Resources to Support Achievement of Outcomes**: The a-k outcomes for the Mechanical Engineering program are provided below for reference:
    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
    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
    d. an ability to function on multi-disciplinary 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.

In summary, the resources are as follows:

1) Adequate financial support for teaching activities and professional development,
2) Stable infrastructure for decision making and execution of plans
3) Effective system implementing software and physical resource improvements.

4) Exclusive use, with the exception of four lecture areas, of a new 125,000 sq. ft. Engineering Center to be occupied in August 2014. (Our School of Engineering and Computer Science also claims about fifty additional rooms/labs in our older buildings for research activities in which our undergraduate students may participate.)

Therefore, the resources to support the achievement of the student outcomes are adequate.

C. Staffing

In addition to that from the full-time faculty, the Mechanical Engineering program receives support from adjunct professors and part-time instructors who are held to the same classroom standards as those imposed upon the full-time faculty. The body of staff members for the remaining aspects of the support is listed below:

Administrative staff

Dean's Office **–** Staff of 9: The associate dean, working with the administrative assistants, provides most of the higher level support. Support includes counseling in relation to course work, mentoring for at-risk students, intervention in relation to professor/student disputes, petition of exception approvals, and second degree application reviews.

Department Secretary: Working in consultation with the department chair, the department secretary provides support which includes scheduling management, general course advice, teaching assistantship paperwork, referrals to professors, and directions in relation to sources of information that may be useful to students.

Undergraduate Advisors: A staff of three academic advisors and one administrative assistant serves the students in the Mechanical Engineering program from the advising office. The staff spends much of their time in face-to-face meetings with students to help them grapple with scheduling and plan of study strategies.

Technical staff

Lab Manager: Working with his staff of student employees, our lab manager provides a critically important service to students and faculty. Services provided include supervising structural changes to laboratory/classroom furniture, computer systems, equipment, and signage, as well as providing technical support to students in relation their sophomore or senior design projects.

IT Support: Working with his staff of about five employees, the computer network administrator in our Computer Technology Office (CTO) provides another critical service to the students and faculty. Services provided include procurement of software and computer hardware, installation and management of software, data storage management, data security management, and trouble shooting.

Machine Shop: Faculty and students have access to machine shop services at two locations: Dodge Hall Machine Shop, Hannah Hall Machine Shop. Both machine shops provide professional services from our full-time OU project engineers. These project engineers routinely provide, not only basic machine shop services, but also technical guidance to students for their course projects. Beginning in Fall 2014, faculty and students will have access to the state-of-the art machining facilities in the new Engineering Center.

The support available to students in the Mechanical Engineering program is satisfactory. However, with the new laboratories and new specialized equipment, additional support staff for the laboratories would significantly enhance the maintenance and use of that equipment and the student experience.

D. Faculty Hiring and Retention

Before the formal process begins, informal reviews of our assessment data are carried out in order to establish a vision for the school needs with respect to hiring a new faculty member. All hiring processes for new faculty are carried out in accordance with the Oakland University Office of Academic Affairs (Policy # 750). Word-for-word excerpts from the policy are provided in italics below for reference.

Process for Hiring of New Faculty

1. *Deans, the Director of the Eye Research Institute (ERI) and chairs anticipating open positions as well as potential search committee members will be provided with recruitment training.*
2. *Vice President for Academic Affairs authorizes filling position.*
3. *Department chairperson appoints the Search Committee with the approval of the Dean. Where the college, the institute, the library or a school does not maintain separate departments, the Dean or Director of the ERI shall appoint the Search Committee. A check list will be provided to Deans or Director of the ERI to assist in identifying issues relevant to the search.*
4. *Search Committee:*
   - *Reviews provided assessment checklist to organize search effectively.*
   - *Contacts Office of Equal Opportunity for forms and further information relative to implementation of this procedure.*
   - *Develops proposed minimum qualifications and a position description subject to administrative approval as provided on the Faculty Recruitment Record.*
   - *Prepares advertisement and posting.*
   - *Develops selection criteria.*
   - *Develops recruitment plan.*
   - *Completes section A of Faculty Recruitment Record and identifies initial sources for Section B.*
5. *Dean or Director of ERI reviews section A and proposed sources in Section B of Faculty Recruitment Record.*

6. After approval has been received from the Dean or Director of ERI, the Search Committee, through departmental or school channels:

- *Sends posting to AAUP, Office of Equal Opportunity and the Office of the Vice President for Academic Affairs.*
- *Places advertisement in external publications and makes external contacts.*
- *Receives candidate materials and sends acknowledgments.*
- *Provides the Office of Equal Opportunity with the names and contact addresses of all candidates meeting minimum qualifications. The OEO will then send these individuals affirmative action inquiry cards.*

7. Office of Equal Opportunity provides Search Committee with summary of responses to affirmative action inquiry cards, and any other information relative to the availability of members of protected groups for the position on a timely basis. The OEO may recommend to the Search Committee continuation of search for qualified candidates when the initial pool of candidates does not provide a representative group of candidates.

8. Search Committee screens candidates to arrive at a proposed group of finalists, updates section B and completes section C of Faculty Recruitment Record and sends it to the Dean, Director of the ERI or Chairperson.

9. Chairperson of Department, Dean or Director of ERI, Director of Office of Equal Opportunity and Office of the Vice President of Academic Affairs approve section C. The Office of the Vice President for Academic Affairs may require a continuation of the search for qualified candidates.

10. Finalists are interviewed and otherwise additionally screened by the hiring unit and an employment recommendation is formulated. Hiring unit completes section D of the Faculty Recruitment Record and a written narrative (see Appendix A).

11. Chairperson of Department, Dean or Director of ERI, Director of Office of Equal Opportunity, and the Office of the Vice President for Academic Affairs approve section D. The Office of the Vice President for Academic Affairs will review all hiring recommendations with the OEO prior to rendering a decision.

12. Dean or Director of the ERI makes offer of employment to an approved candidate subject to Board approval for tenure track positions.

Search Committee

When faculty positions are to be filled, the department chairperson will appoint a Search Committee. It is recommended that female, minority and persons with disabilities be included wherever possible. The Search Committee shall develop the position description, which shall include the minimum qualifications for the position. The Federal Guidelines for Employee Selection Criteria require that all qualifications used to screen applicants be directly related to the position being filled. Those qualifications must all be necessary to perform the work successfully and be measurable to demonstrable. Every reasonable effort shall be made to avoid *using standards which are not necessary to perform the responsibilities of the position and which might have the effect of excluding protected groups.*

An advertisement shall be developed by the Search Committee. It must include the minimum qualifications for the position, and a statement that Oakland University is an equal opportunity and affirmative action institution. The Dean or Director of ERIs approval of the position description, minimum qualifications and the advertisement is required prior to dissemination of the advertisement.

The Search Committee shall also prepare a recruitment plan. A good faith effort must be made to attract female, minority and disabled applicants by contacting organizations and publishers which serve these groups, as well as individuals who may know of qualified candidates. This effort shall be documented on section B of the Faculty Recruitment Record. The recruitment plan can be expanded during the search.

A position should be advertised in appropriate publications at least two months in advance of the closing date for accepting applications. A closing date should be included in the advertisement; the following language is suggested: "In order to ensure consideration, applications must be received by (date)."

The Office of Equal Opportunity must be consulted in development of job descriptions, advertisements and recruiting plans.

Screening Procedures

The Search Committee shall develop selection criteria, subject to the approval of the department chairperson and the Dean or Director of ERI. Accurate and valid criteria are essential to nondiscriminatory rankings of the candidates. Some examples of selection criteria are: amount, relevance and quality of formal education; amount, relevance and quality of previous teaching experience; amount, relevance and quality of research activities, publications or presentations; ability to communicate effectively with students and staff, and involvement in professional organizations. Further information regarding development of valid selection criteria may be obtained by contacting the Office of Equal Opportunity.

In screening applicants, the Search Committee should first eliminate all persons who do not meet the stated minimum qualifications (non-qualified). The confidential affirmative action inquiry cards shall be sent to all qualified candidates by the Office of Equal Opportunity. The Search Committee shall provide the office with a list of names and addresses of all candidates who meet the minimum qualifications. It is to the committee's benefit to submit these names and addresses on a rolling basis in order to determine whether the pool is representative as early as possible in the process.

After initial screening, the Search Committee should evaluate the materials submitted by each of the remaining candidates. Consideration of each candidate should be based on the selection criteria developed by the Committee. Evaluation techniques must be uniformly applied to all candidates.

On-Campus Interviewing

Following the screening and a review of data provided by the Office of Equal Opportunity from the affirmative action inquiries, the Committee shall recommend candidates to be interviewed, *and section C of the Faculty Recruitment Record shall be completed by the Search Committee and reviewed by the Dean or Director of ERI, the Director of OEO and the Office of the Vice President for Academic Affairs. Where there is evidence that qualified minorities, women or persons with disabilities should be available in the potential pool of candidates, the Committee may be required to continue the search for qualified candidates. The decision to extend the search shall be made by the Office of the Vice President for Academic Affairs after consultation with the Dean or Director of ERI and the Director of OEO.*

The objective of the campus interview phase is to assess an individual's qualifications to perform the required duties of the position, as designated by the job description and selection criteria. The Search Committee should ensure that all candidates are treated in an equivalent manner, both in respect to the substance of the interview and the arrangements on and off campus.

Upon completion of the interviews, the candidates shall be discussed by the Search Committee and a candidate or candidates recommended, in order of preference. Where two or more candidates possess similar qualifications, consideration shall be given to the impact the selected candidate will have on the achievement of Oakland University's affirmative action goals.

At the conclusion of the process, section D of the Faculty Recruitment Record shall be completed by the Search Committee and reviewed by the Dean or Director of ERI, the Director of the Office of Equal Opportunity, and the Office of the Vice President for Academic Affairs, the latter after consultation with the OEO. The committee is expected to support Section D by attaching a narrative. An example narrative can be found in Appendix A. The offer of employment shall be made by the Dean or Director of ERI for regular full-time faculty positions and for visiting appointments.

Strategies used to retain current qualified faculty

With the understanding that all of our tenure-track faculty are responsible for production in the area of teaching, research, and service, new faculty (especially less experienced new faculty) are steered away from heavy service loads; this allows them to concentrate more on their research and teaching, thereby affording them the best path toward retention and promotion. New faculty are encouraged to introduce new courses and are provided with a start-up fund to help them establish their research programs. During their first few years, new faculty meet more frequently with their department chair for guidance. Formal reviews of the faculty member’s performance are carried out with the first one being at the conclusion of their first year. Among other recommendations for maintaining or achieving strong teaching performance, new faculty are advised to participate in workshops at the university’s Center for Excellence in Teaching and Learning.

E. Support of Faculty Professional Development

As articulated in Sections 8.B.1 and 8.B.2, both financial support and organizational support are provided to faculty to help advance their professional development. As a result, they have ample opportunity to participate in on-campus workshops for teaching skills training as well as in national-level professional conferences. Beyond the support for participating in on-campus workshops and for travel to professional development conferences, faculty have the opportunity to advance their professional development goals through sabbaticals. The general process involves a written statement of the professor's plans that includes specific deliverables. This statement is submitted to the Dean for approval. Sabbaticals are regularly approved each year, but in order to ensure that program standards are not compromised, the Dean will occasionally deny sabbatical requests. At the conclusion of a sabbatical leave, a final report is submitted to and archived in the Dean's office for future reference.

PROGRAM CRITERIA

The curriculum for the Mechanical Engineering program meets all the ABET requirements for accreditation as indicated in Table 5-1 and as discussed in Criterion 5: Curriculum. ME 486 and ME 456/482 assure that the specific program criteria are met for the ability to work professionally in both thermal and mechanical systems. The description of the professional development of the faculty in Section 6.D (Faculty Development) and a review of faculty CV's in Appendix B demonstrates that the faculty are maintaining currency in their specialty area.

GENERAL CRITERIA FOR ADVANCED-LEVEL PROGRAMS

No accreditation is sought at the graduate level.

APPENDICES

Appendix A – Course Syllabi

1. *Course number and name:*
   EGR120 – Engineering Graphics and CAD

2. *Credits and contact hours:*
   1 credit hour; 1.12 contact hours/week (Lecture) and 1 contact hour/week (Lab)

3. *Instructor's or course coordinator's name:*
   Randy Gu, Professor of Engineering

4. *Text book title, author, and year:*
   - None

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      An introduction to the techniques for creating solid models of engineering designs. Topics include three-dimensional modeling of parts and assemblies, visualization, orthographic project views and layouts, auxiliary, sectional, and cutout views, exploded views, dimensioning and tolerancing, bill of materials, and computer-generated design documentation. Offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisite: None.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required for engineering and engineering science majors

6. *Specific goals for the course:*
   a. *Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
      To acquaint students with the principles of engineering graphics and the state-of-the-art computer-aided design (CAD) technology. By the end of the course, the successful student will be able to:

      - Use commercial CAD software to create 2D drawings (b, g, k);
      - Create 3D parametric solid models (b, e, g, i, k);
      - Create detailed drawings of projection views of 3D objects (a, b, g, k);
      - Build virtual assemblies and animate their mechanism (b, g, k);
      - Create bill of materials and detect clashes of assemblies (g, k);

   b. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
      Course addresses ABET Student Outcome(s): a, b, e, g, i, k

7. *Brief list of topics to be covered:*
   - Overview of course: Schedule, lab lock, computer account, website, material posted online;
   - CATIA Fundamentals: CATIA settings; toolbars management; hide and show part features; apply materials; surface rendering; insert part body; Boolean operations; various techniques for viewing model.
   - Geometric & Dimensional Constraints: Sketch tools: point, line, profile, circle, arc, rectangle, elongated hole, corner, editing, geometric and dimensional constraints; apply materials; mass, centroid, and area moment of inertia of composite areas.
   - Parametric Solid Modeling: Pad, pocket, shaft, rib, slot, edge fillet, tritangent fillet, shell, and transformation; define parameters and formulas; mass, centroid, and mass moment of inertia of 3D objects.
   - Assembly Design: Engineering graphics principles, projection view layout, dimensioning, auxiliary and sectional views, and title block.
   - Drafting & Engineering Graphics: Engineering graphics principles, projection view layout, dimensioning, auxiliary and sectional views, and title block.

1. *Course number and name:*
   EGR 141 - Computer Problem Solving In Engineering And Computer Science

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week (Lecture) and 2.83 contact hours/week (Lab)

3. *Instructor's or course coordinator's name:*
   Mohammad Siadat, CSE Department

4. *Text book title, author, and year:*
   - *An Introduction to Programming Using Visual Basic*, D. Schneider, Prentice Hall, (ISBN 978-0-133-45086-6).
   - *MATLAB - An Introduction with Applications*, A. Gilat, 4th edition, Wiles and Sons, (ISBN 978-0-470-91313-0).

5. *Specific course information*
   a. *Brief description of the content of the course (catalog description):*
   General methods of problem solving and principles of algorithmic design using a high-level language such as Visual Basic.NET. Introduction to MATLAB. Applications will be drawn from problems in mechanical, electrical and computer engineering and computer science. Offered fall and winter.

   b. Prerequisites or co-requisites:
   Corequisites: MTH 154 or equivalent.

   c. Indicate whether a required, elective, or selected elective course in the program
   Required of engineering and engineering science majors

6. *Specific goals for the course:*
   a. Course Objectives (letters between parentheses show mapping to ABET student outcomes)
   In order to satisfactorily complete this course, a student is expected to demonstrate competency concerning their understanding of the following objectives:
   - Solve problems in Engineering and Computer Science (a, b, d, e, h, k)
   - Design an algorithm and use Visual Basic .NET to develop a program (a, b, c, e, k)
   - Use events in the design and implementation of graphical user interfaces (a, b, c, e, k)
   - Use forms, buttons, textboxes, radio buttons, and list boxes in Visual Basic .NET (a, b, c, e, k)
   - Develop Visual Basic .NET code for functions, loops, decision structures (if, case) (a, b, c, e, k)
   - Use the Visual Basic .NET debugger to watch variables and program execution (a, b, c, e, k)
   - Use memory and storage properly including variables, arrays, sequential files and a database using Visual Basic .NET (a, b, c, e, k)
   - Use MATLAB Toolbox functions to solve problems (a, b, c, e, k)

b. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
Course addresses ABET Student Outcome(s): a, b, c, d, e, h, k

7. *Brief list of topics to be covered:*

- Visual Basic
  - Introductory programming concepts, algorithm
  - Design, and the Visual Basic .NET environment
  - Fundamentals of event-driven programming
  - Data types, variables, and assignment statements
  - Arithmetic operators and scope
  - Decisions and data validation
  - Simplifying programming through modularity
  - Error handling
  - Repetitive structures/loops
  - Arrays
  - Sequential files
  - Introductory database programming with data
  - Objects
- MATLAB
  - An introduction to using MATLAB for solving problems in engineering
  - Using matrices in MATLAB, debugging in MATLAB, and using and creating functions in MATLAB
- Problem solving
  - Uncertainty and design
  - Divide and conquer techniques in electronics and dynamics
  - Estimating and predicting unknowns
  - Simulation
  - Noise and filtering

1. *Course number and name:*
   EGR 240: Introduction to Electrical and Computer Engineering

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week (Lecture) and 3 contact hours/week (Lab)

3. *Instructor's or course coordinator's name:*
   Brian Dean, ECE Department, Assistant Professor of Engineering

4. *Text book title, author, and year:*
   - Introduction to Digital Design Using Digilent FPGA Boards - Block Diagram/Verilog Examples, R.E. Haskell and D.M. Hanna, LBE Books, 2009 (ISBN 978-0-9801337-9-0).
   - Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku, 5th edition, McGraw Hill, 2013 (ISBN 0073380571).

   a. *Other supplemental materials:*
   - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
   An introduction to the fundamentals of electrical and computer engineering; DC and AC circuits, digital logic circuits; combinational logic design; sequential circuits, introduction to electronics, operational amplifiers, DC electromechanical machines. With laboratory. Offered fall and winter.

   b. *Prerequisites or co-requisites:*
   Prerequisite: EGR 141 or CSE 142.
   Prerequisites or corequisites: MTH 155, PHY 161 or (PHY 151 and PHY 110).

   c. *Indicate whether a required, elective, or selected elective course in the program*
   Required of engineering and engineering science majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - Convert a number in one base (decimal, binary, hexadecimal) to another and vice versa (a)
   - Identify basic gates (NOT, AND, OR, NAND, NOR, XOR, XNOR) and list the truth tables for each gate (b, k)
   - Find the reduced form of any logic function with 3 or 4 inputs by using Karnaugh maps (a, b, c)
   - Simulate basic digital circuits using Verilog and synthesize these circuits in an FPGA (b, c, e, k)

- Find the voltages and currents in basic DC circuits (a, b, c, k)
- Describe the meaning of phasor voltages and currents in steady-state AC circuits (a, b, c, k)
- Find the voltages and currents in basic AC circuits (a, b, c, k)
- Set up the nodal and mesh matrix equations for AC and DC circuits (a, b, c, k)
- List the properties of an ideal operational amplifier and use these properties in circuit analysis (b, e)
- Find the power dissipated in an electric circuit (a, b, c)
- Describe how the speed of a DC motor affects the armature current (a, b, c)

d. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:

Course addresses ABET Student Outcome(s): a, b, c, e, k

7. *Brief list of topics to be covered:*

- Number Systems
- Basic Logic Gates; Introduction to Basic Digital Design; Boolean Algebra
- Karnaugh Maps; Digital Design; Techniques for implementing logic gates
- Universal Gates; Introduction to HDL design of multiple input gates; Digital Design: Equality Detector, Multiplexers, Clocks and Counters
- Fundamental Electrical Concepts; Fundamental Mathematics
- Circuit Analysis: Dividers and the Wheatstone Bridge, RMS Values, and Introduction to Mesh and Nodal Analysis
- Circuit Analysis: Advanced Nodal and Mesh Analysis
- Circuit Analysis: DC and AC Operational Amplifiers, Source Transformation, Superposition
- Digital Design: Thevenin and Norton Equivalent Circuits, Maximum Power Transfer Introduction to Electromechanical machines: DC Motors
- Circuit Analysis: DC/AC Power
- Circuit Analysis: DC/AC Power, Simplified Mesh and Nodal Analysis

1. *Course number and name:*
   EGR 250: Introduction to Thermal Engineering

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week (Lecture) and 2 contact hours/week (Lab)

3. *Instructor's or course coordinator's name:*
   Laila Guessous, Associate Professor of Engineering

4. *Text book title, author, and year:*
   - Introduction to Thermodynamics and Heat Transfer, 2nd ed., Yunus Cengel, McGraw-hill, 2007

   a. *Other supplemental materials:*
   - Extensive course notes and handouts

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
   Introduction to the fundamentals of classical thermodynamics and heat transfer; first and second laws of thermodynamics; thermodynamic property relationships; application to engineering systems and processes, steady and transient conduction in solids; introduction to convection heat transfer correlations. Offered fall, winter. Repeat course for ME 241. Offered fall and winter.

   b. *Prerequisites or co-requisites:*
   Prerequisites: CHM 143 (or CHM 144 and CHM 147), EGR 141, PHY 161 (or PHY 151 and PHY 110).
   Corequisite: APM 255.

   c. *Indicate whether a required, elective, or selected elective course in the program*
   Required of engineering and engineering science majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - List and describe relevant thermodynamic terminology related to thermodynamic systems and properties. Demonstrate proficiency in performing unit conversions. (a)
   - Design and perform experiments. Formulate, evaluate and calculate experimental uncertainties of indirect measurements. Analyze experimental data and write technical reports. (b, d, f, g, i, k)
   - Interpret thermodynamic property tables and graphs. Calculate property values, and apply to various thermodynamic equations of state. (a, e)
   - Explain and apply the First Law of Thermodynamics (Conservation of Energy Principle) and the Conservation of Mass Principle to model a variety of open and

closed thermodynamic systems, such as nozzles, turbines, throttling valves, heat exchangers, refrigeration systems, vapor cycle power plants. (a, e, k)
- Explain and apply the Second Law of Thermodynamics to a variety of thermodynamic processes and to model a variety of open and closed thermodynamic systems. Describe its implications and influences. (a, e, k)
- Describe the physical mechanisms associated with the three fundamental heat transfer modes. (a)
- Apply the concepts of one-dimensional steady conduction to the solution of problems involving plane, curved and composite walls; use the thermal resistance concept to model and solve thermal network problems (a, e, k)
- Evaluate the steady rate of heat transfer, efficiency and effectiveness of finned surfaces (a, e, k)
- Formulate and apply the lumped capacitance method for the solution of transient conduction problems. (a, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, d, e, f, g, i, k

7. *Brief list of topics to be covered:*
   - Basic concepts: dimensions, units, continuum, open/closed system, intensive/extensive properties, process/cycle, density, pressure and pressure measuring devices, temperature; Uncertainty Analysis (in lab)
   - Energy and energy transfer; Forms of energy; Energy transfer by heat; heat transfer modes; Energy transfer by work; moving boundary work, including polytropic process; Internal energy; First Law of Thermodynamics
   - Properties of a pure substance; property diagrams for phase change processes; Saturation pressure and temperature; Property tables (water and refrigerants);
   - Ideal gas law; incompressible substances; Energy analysis of closed systems
   - Conservation of mass and energy for control volumes; flow work
   - Application of the conservation of mass and energy principles to steady-flow engineering devices (nozzles, diffusers, turbines, compressors, pumps, heat exchangers, valves)
   - The second law of thermodynamics; Cycle efficiency and coefficient of performance; irreversibility; Kelvin-Planck and Clausius Statements of the second law; Carnot cycle
   - Entropy; the Clausius statement; the increase of entropy principle; Entropy generation; Evaluating entropy change using property tables and property relations
   - Isentropic processes; Isentropic efficiencies of steady flow devices (nozzles, pumps, compressors, turbines);
   - Mechanisms of heat transfer: Conduction, convection and radiation
   - Steady one-dimensional heat conduction; Temperature distribution in a plane wall; Thermal resistance; Multilayer plane walls; Thermal contact resistance; Heat conduction in cylinders; critical radius of insulation
   - Lumped system analysis; criteria for lumped system analysis: Biot number; Heat transfer from finned surfaces; fin efficiency and fin effectiveness; fin arrays

1. *Course number and name:*
   EGR 260: Introduction to Industrial and Systems Engineering

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week for lecture, 3 contact hours/week for lab

3. *Instructor's or course coordinator's name:*
   Robert Van Til, Professor of Engineering

4. *Text book title, author, and year:*
   - Applied Statistics and Probability for Engineers, D.C. Montgomery and G.C. Runger, 5th edition, Wiley, 2011 (ISBN 978-0-470-91061-0). (Moving to 6th edition in the summer of 2014.)

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*

   a. *Brief description of the content of the course (catalog description):*
      Overview of industrial and systems engineering: perspectives, tools and models. In depth coverage of probability and statistics in engineering: density and distribution functions, population and sampling distributions, confidence intervals, hypothesis testing and introduction to discrete- event simulation. Offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisite: MTH 155

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required of engineering majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - Describe the role of an Industrial Engineer in a manufacturing/service industry (j)
   - Understand the concept of population distribution and sample distribution (a, e)
   - Apply probability concepts of counting, mean, variance, expectation and others (a, e)
   - Apply discrete distributions including uniform, binomial, Poisson, geometric, and others (a, e)
   - Apply continuous distributions including uniform, normal, exponential, lognormal and others (a, e)
   - Estimate parameters with a given level of confidence (a, e)
   - Apply the concept of probability to real world problems (a, e)
   - Analyze data and estimate variation in a data set (a, b, e, k)
   - Apply probability and statistical operations on data using Excel (a, b, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, e, j, k

7. *Brief list of topics to be covered:*

- Probability
  - Sample spaces and events; Interpretations and axioms of probability
  - Addition rules; Conditional probability
  - Multiplication and total probability rules
  - Independence; Baye's theorem; Random varibles
- Discrete random variables and probability distributions
  - Discrete random variables
  - Probability distributions and probability mass functions
  - Cumulative distribution functions
  - Mean and variance of a discrete random variable
  - Discrete uniform distribution
  - Binomial distribution
  - Geometric and negative binomial distributions
  - Hypergeometric distribution
  - Poisson distribution
- Continuous random variables and probability distributions
  - Continuous random variables
  - Probability distributions and probability density functions
  - Cumulative distribution functions
  - Mean and variance of a continuous random variable
  - Continuous uniform distribution
  - Normal distribution
  - Exponential distribution
  - Erlang and gamma distribution
  - Weibull distribution
- Joint probability distributions
  - Two or more random variables
  - Covariance and correlation
- Descriptive statistics
  - Probability plots
- Sampling distributions and point estimation of parameters
  - Confidence interval on the mean of a normal distribution
  - Confidence interval on the variance and standard deviation of a normal distribution
  - Guidelines for constructing confidence intervals
  - Statistical intervals for a single sample
- Tests of hypotheses for a single sample
  - Hypothesis testing
  - Tests on the mean of a normal distribution

1. *Course number and name:*
   EGR 280: Design and Analysis of Electromechanical Systems

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week for lecture, 3 contact hours/week for lab

3. *Instructor's or course coordinator's name:*
   Osamah Rawashdeh, Associate Professor of Engineering
   J. David Schall, Assistant Professor of Engineering

4. *Text book title, author, and year:*
   Learning by Example Using C - Programming the DRAGON12-Plus Using CodeWarrior by Richard E. Haskell and Darrin M. Hanna.
   a. *Other supplemental materials:*
   Selected readings and online lectures from http://www.ecourses.ou.edu/ (free e-Book) are assigned for the Statics and Dynamics portion of the course.

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Design, analysis, and testing of electromechanical systems; statics, linear and rotational dynamics; introduction to microprocessors; team design project dealing with technical, economic, safety, environmental, and social aspects of a real-world engineering problem; written, oral, and visual communication, engineering ethics. Offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: EGR 120, EGR 240
      Corequisites: EGR 250, EGR 260

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required of engineering and engineering science majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   - Write C programs to interface a microcontroller to external devices and to download the program to flash memory in a microcontroller using modern development tools. (a,e,k)
   - Solve statics problems involving particles and rigid bodies. (a,e)
   - Solve kinematic and kinetic dynamics problems involving particles and rigid bodies using Newton's Second Law, Work and Energy, and Impulse and Momentum principles. (a,e)
   - Explain and illustrate the basic concepts of engineering ethics and apply them in practice. (c,f,h)
   - Work constructively in a multidisciplinary team to design, analyze, and describe an electromechanical system subject to specific constraints. (a-k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, d, e, f, g, h, i, j, k

7. *Brief list of topics to be covered:*

The course is divided into 5 portions:

1. Microcontroller Digital I/O and Data Acquisition (~ 3 weeks)
2. Actuators Interfaces and Intro to Feedback Control (~ 2 weeks)
3. Statics (~ 4 weeks)
4. Dynamic (~ 3 weeks)
5. Final Project (~2 weeks)

1. *Course number and name:*
   ME 308 - Computer-Aided Design

2. *Credits and contact hours:*
   3 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Randy Gu, Professor of Engineering

4. *Text book title, author, and year:*
   - *Introduction to CATIA V5 Release 19* (*A Hands-On Tutorial Approach*), Kirstie Plantenberg, ISBN: 978-1-58503-534-2, SDC Publications (www.sdcpublications.com)
   - *CATIA V5 FEA Tutorials*, Release 21, Nader Zamani, ISBN: 978-1-58503-762-9, SDC Publications (www.sdcpublications.com).

   a. *Other supplemental materials:*
      - *CATIA V5 Tutorials Mechanism Design & Animation*, Release 21, Jonathan M. Weaver and Nader Zamani, ISBN: 978-1-58503-652-3, SDC Publications (www.sdcpublications.com).

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Use of engineering software in design and analysis such as: GD&T; solid modeling of machine parts, projection views layout, parametric and knowledge-based design, assembly design, sheet and metal design, build of materials, structure design, introduction of finite element method, engineering optimization, space analysis and clash detection, mechanism and kinematics of assemblies, project management. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites or corequisites: ME 361 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required for mechanical engineering major

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   To acquaint students with the state-of-the-art computer-aided design (CAD) technology in ME design problems such as stress analysis, dynamic structural response, heat conduction, etc. By the end of the course, the successful student will be able to:
   - Demonstrate proficiency in the principles of engineering graphics (b, g);

- Demonstrate proficiency in creating planar sketches using a commercial CAD package (a, b, e, g, k);
- Design 3D parametric solid models using a commercial CAE package (a, b, c, e, g, k)
- Design and animate mechanical systems consisting of a number of components using a commercial CAE package (a, b, c, e, g, k);
- Formulate and solve finite element equations for 2D frames consisting of two-node bar and beam elements (a, b, e, k);
- Analyze machine components and mechanical systems subject to certain boundary and loading conditions using a commercial CAE package (a, b, c, e, g, k);

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
Course addresses ABET Student Outcome(s): a, b, c, e, g, k

7. *Brief list of topics to be covered:*

- Assembly Design, Kinematics and Mechanism Design
  Constraints, manipulating components, joints, simulation, laws
  - Ex01 Tool post assembly
  - Ex02 Truck assembly running at constant velocity/acceleration
  - Ex03 Tow truck and four-bar mechanism
- Finite Element Analysis
  Theory of finite element method, stress analysis of individual machine elements subject to various loading conditions, mesh quality, symmetric models, post-processing
  - Ex04 Fundamental of FEA – Deflection of a bent beam using Excel and CATIA
  - Ex05 Stress in a rotating disk / flywheel
  - Ex06 Deformation due to gravity / body-force
  - Ex07 Fastening a rail to fixture

  Finite element modeling of mechanical systems, virtual parts and connections, symmetric models
  - Ex08 Bearing-shaft system subject to a center load
  - Ex09 FEA – Shaft-Rotor-Brakepad Assembly
- Part Design & Knowledge Advisor
  Parametric design, design table, VB coding & user interface design
  - Ex10 Design of a Sprocket
- Part Design, Wire Frame & Surface Design
  Points, lines, helix, splines, sweep, join, close surface, thick surface, sew surface
  Multi-section solid, shell, split solid, Boolean operations
  - Ex11 Sew surface to various solids
  - Ex12 Sail boat
- Sheet Metal Design
  Walls, reliefs, bends, bridge, bead, rib
  - Ex13 A computer hardware component – bracket
- Drafting
  Principles of engineering graphics, scales, engineering lines, orthographic projection, sectional views and conventions, auxiliary views;
  - Ex14 Detail drawing of a part

1. *Course number and name:*
   ME 322: Engineering Mechanics (Statics and dynamics)

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week for lecture, 2 contact hours/week for lab

3. *Instructor's or course coordinator's name:*
   J. David Schall, Assistant Professor of Engineering
   Keyu Li, Professor of Engineering

4. *Text book title, author, and year:*
   - Hibbeler, Engineering Mechanics Statics and Dynamics, 13th Edition, Pearson Prentice Hall (ISBN-10: 0-13-291548-0)

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Statics and dynamics of particles and rigid bodies: analysis of trusses, frames, beams, centroids and moments of inertia; kinematics, Newton's Second Law, work and energy, linear and angular impulse and momentum. With laboratory. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: EGR 280 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required of mechanical engineering majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*

The primary objective of this course is to provide the student with a basic background in statics and dynamics, beyond those covered in the introductory course EGR 280. The course should also enhance the student's analytical ability, logical reasoning, and experimental skills. The student is expected to be able to carry out the following tasks upon completion of the course:

- Design and perform experiments. Analyze experimental data and write technical reports (a,b,d,f,g,k)
- Apply Newton's second law to describe the static and dynamic equilibrium conditions of particles and rigid bodies. (a,e)
- Determine the internal forces in the members of a truss. (a,e)
- Express graphically and analytically the shear and bending moment of a beam.

- Apply Coulomb's law of dry friction to determine equilibrium forces on wedges and belts (a,e)
- Determine the centroid of an area (a,e)
- Determine the moment of inertia of a plane area with respect to a given axis. (a,e)
- Determine the mass moment of inertia of a body about a given
- axis. (a,e)
- Apply the kinematics theory to determine the relative velocity and relative acceleration between two points in a rigid body in planar motion (a,e)
- Apply work and energy principles to describe an analyze the kinetics of a rigid body. (a,e)
- Apply the principles of impulse and momentum to describe and analyze the kinetics of particles (a,e)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, d, e, f, g, k

7. *Brief list of topics to be covered:*
   General mechanical principles and problem solving skills.
   - Force vectors, vector operations, dot products, cross products.
   - Static equilibrium of particles and rigid bodies.
   - Force system resultants.
   - Kinetics and kinematics of particles and rigid bodies.
   - Work and energy of particles and rigid bodies.
   - Impulse and momentum of particles and rigid bodies.

1. *Course number and name:*
   ME 331: Introduction to Fluid and Thermal Energy Transport

2. *Credits and contact hours:*
   4 credits hours; 3.57 contact hours/week for lecture, 2 contact hours/week for lab

3. *Instructor's or course coordinator's name:*
   Xia Wang, Associate professor of Engineering

4. *Text book title, author, and year:*
   - Fox and McDonald's Introduction to Fluid Mechanics, P.J. Pritchard, 8th edition, John Wiley & Sons, 2011
   - Introduction to Thermodynamics and Heat Transfer, Yunus Cengel, 2nd edition, McGraw-hill, 2008.

   a. *Other supplemental materials:*
   Extensive course notes and handouts

5. *Specific course information:*

   a. *Brief description of the content of the course (catalog description):*
   The fundamentals of fluid mechanics and heat transfer, conservation and momentum principles, viscous and inviscid flow, laminar and turbulent flow, introduction to viscous and thermal boundary layer theory, one-dimensional conduction heat transfer and characteristics and dimensionless correlations of convection heat transfer, applications to engineering problems. With laboratory; includes experiment design. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
   Prerequisites: EGR 250, MTH 254 and major standing.
   Pre/Corequisites: EGR 280.

   c. *Indicate whether a required, elective, or selected elective course in the program Required*
   Required of mechanical engineering and engineering science majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

- List and define elementary terminology related to fluid flow and heat transfer; explain the different types of flow and flow field descriptions. Describe the different mechanisms of heat transfer. (a)

- Design and perform experiments. Formulate, evaluate, and calculate experimental uncertainties of indirect measurements. Analyze experimental data and write technical reports. (b, d, f, g, i, k)
- Explain the integral form of the conservation of mass and momentum principles and apply to a variety of static and dynamic fluid problems. (a, e, k)
- Describe the development of the Bernoulli and Euler's equations for inviscid flows and list the underlying assumptions; apply the Bernoulli equation to appropriate engineering problems. (a, e, k)
- Describe the meaning and the physical significance of the continuity and Navier-Stokes equations. (a)
- Derive the velocity profile in a simple laminar viscous flow; explain viscous drag and the role of the Reynold's number in distinguishing between laminar and turbulent flows; evaluate the pressure drop in single-path piping systems. (a, e, k)
- Apply the concepts of one-dimensional steady conduction to the solution of problems involving plane, curved and composite walls, and extended surfaces (fins); evaluate thermal resistances and overall heat transfer coefficients using the electrical analogy. (a, e, k)
- Describe viscous and thermal boundary layers; select and apply suitable empirical forced and natural convection correlations to determine the convective heat transfer coefficients for simple engineering geometries. (a, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, d, e, f, g, i, k

7. *Brief list of topics to be covered:*
   - Introduction of Fluid/Unit
   - Velocity Field; Stress Field, viscosity, Boundary Layer; Hydrostatics
   - Integral Form equation, Mass and Momentum conservation
   - Differential Form Equation, Flow Motions
   - Bernoulli Equation; Static, Stagnation, Total pressure
   - Internal Flow: Pipe flow and Ducts Flow
   - External Flow: Boundary layer flow
   - Review of heat transfer concepts
   - Heat Equation
   - Convection Heat Transfer-External Flow and Internal Flow
   - Heat Exchanger Design

1. *Course number and name:*
   ME361 - Mechanics of Materials

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week for lecture, 2 contact hours/week for lab

3. *Instructor's or course coordinator's name:*
   Qian Zou, Associate Professor of Engineering

4. *Text book title, author, and year:*
   - Mechanics of Materials, 6th Edition, by Beer and Johnston, McGraw-Hill, Inc., 2011

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Introduction to the mechanics of deformable bodies: distribution of stress and strain in beams, shafts, columns, pressure vessels and other structural elements, factor of safety, yield and fracture criteria of materials with applications to design. With laboratory. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: EGR 280 and major standing
      Prerequisite or corequisite: ME 322

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required of mechanical engineering and bio-engineering majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - Calculate normal, shear and bearing stress in deformable solid bodies. (a, e)
   - Apply stress and strain transformation equations and Mohr's circle to determine stress and strain on different planes in solid bodies. (a, e)
   - Interpret the generalized Hooke's law and apply to deformable solid body problems. (a, e)
   - Determine the critical load conditions for column structures. (a, e)
   - Calculate the stress states on thin walled pressure vessels. (a, b, e, g, k)
   - Calculate the stress and angular deformation of circular shafts under torsional load. (a, b, e, g, k)
   - Calculate normal and shearing stresses in beams under bending and transverse loads. (a, e)
   - Calculate deflection of beams under various transverse load systems. (a, b, e, g, k)

- Apply energy methods to the solution of various structures. (a, e)
- Apply the principle of superposition to deformable solid bodies. (a, e)
- Present one of the lab reports orally. (a, b, g, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, e, g, k

7. *Brief list of topics to be covered:*
   - Normal, Shear and Bearing Stress
   - Normal and Shearing Strain
   - Stress-Strain Relationship
   - Axially Loaded Members
   - Torsionally Loaded Members
   - Beams under Pure Bending
   - Composite Beams, Beams with Stress Concentration, Beams under Eccentric Loadings
   - Shear force and Bending Moment Diagrams – Section Method and Graphical Method
   - Stresses in Transversely Loaded Members
   - Stress and Strain Transformations – Force Equilibrium Method and Mohr's Circle
   - Thin-walled Pressure Vessels
   - Failure due to Yield
   - Deflections in Transversely Loaded Members – Integration Method and Supper Position Method
   - Axially Loaded Members in Compression (Columns)
   - Energy Methods – Theories and Applications

1. *Course number and name:*
   ME 372: Properties of Materials

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week for lecture, 3 contact hours/week for lab

3. *Instructor's or course coordinator's name:*
   Gary Barber, Professor of Engineering

4. *Text book title, author, and year:*
   Materials Science and Engineering: An Introduction, William D. Callister, 2009.

   a. *Other supplemental materials:*
      None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      The atomic, molecular and crystalline structure of solids, including a description of x-ray analysis, metallography and other methods of determining structure; correlation of structure with the electric, magnetic and mechanical properties of solids. With laboratory. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: CHM 143 or (CHM 144 and CHM 147), PHY 162 or (PHY 152 and PHY 111) and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required of Mechanical Engineering Majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

- Describe different crystal structures which occur in metals. Calculate linear, planar and volume densities in crystals. (a, e, k)
- Identify imperfections in crystals and explain their effect on material properties. (a, k)
- Calculate diffusion times to satisfy specified design criteria. (a, e, k)
- Describe various mechanical properties and the way they are measured. Use tension test data to calculate mechanical properties. (a, b, d, g, i)
- Describe methods of strengthening in metals. Quantitatively predict effect of cold work on yield and tensile strength. Determine, by experimental techniques, the effect of heat treating on mechanical properties. (a, b, d, g, i)
- Predict if components will or will not fail due to creep or fatigue. (a, e, k)
- Use phase diagrams to determine phases present, composition of phases and fraction of

phases. (a, e, k)

- Know how to produce various microstructures in steels and based on microstructures present, calculate mechanical properties in steels. (a, b, d, g, i)
- Describe crystal structures and mechanical properties of ceramics. (a, e, k)
- Identify deformation and strengthening mechanisms in polymers. Describe applications for various polymers. (a, e, k)
- Determine mechanical properties of composites based on matrix/fiber type and fiber orientation. (a, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
Course addresses ABET Student Outcome(s): a, b, d, e, g, i, k

7. *Brief list of topics to be covered:*
    - Atomic Structure
    - Crystal Structures
    - Imperfections in Solids
    - Diffusion
    - Mechanical Properties of Metals
    - Dislocations
    - Strengthening Mechanisms
    - Fracture, Fatigue, Creep
    - Phase Diagrams, Microstructures
    - Ceramics, Polymer Structures, Characteristics of Polymers
    - Composites
    - Electrical Properties, Thermal Properties.

1. *Course number and name:*
   ME 421: Vibrations and Controls

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Yin-ping (Daniel) Chang, Associate Professor of Engineering

4. *Text book title, author, and year:*
   - Engineering Vibration, 4th ed., Daniel Inman, Prentice Hall, 2014
   - System Dynamics, 4th ed., Katushiko Ogata, Prentice Hall, 2004

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Linear free and forced response of one- and multiple-degree freedom systems. Equations of motion of discrete systems. Vibration isolation, rotating imbalance and vibration absorbers. Transfer function and state-space approaches to modeling dynamic systems. Time and frequency domain and analysis and design of control systems. Use of MATLAB. Generally offered fall.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 322, MTH 254, APM 255 and major standing

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required for mechanical engineering majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - Derive the E.O.M. (Equations Of Motion) of vibration systems. (a, e, k)
   - Formulate and solve for linear free response of a SDOF (Single Degree Of Freedom) system. (a, e, k)
   - Formulate and solve for linear forced response of a SDOF system. (a, e, k)
   - Derive the E.O.M. for MDOF (Multiple Degrees Of Freedom) vibration systems and solve for response. (a, e, k)
   - Analyze and design dynamic systems in time and frequency domains. (a, b, c, e, k)
   - Analyze and design control systems in time and frequency domains. (a, b, c, e, k)

   a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*

Course addresses ABET Student Outcome(s): a, b, c, e, k

7. *Brief list of topics to be covered:*
   - Derive the EOM of vibration systems, includes Newton's Laws and free body diagrams.
   - Formulate and solve for linear free response of a SDOF system, includes undamped and damped (underdamped, overdamped and critically damped) systems.
   - Formulate and solve for linear forced response of a SDOF system, includes rotating imbalances and base excitations.
   - Derive the E.O.M. for MDOF vibration systems and solve for response, includes vibration isolation and vibration absorbers.
   - Analyze and design dynamic systems in time and frequency domains, includes the use of transfer function, Laplace transform and state space approaches, and Matlab and Simulink virtual experiment techniques.
   - Analyze and design control systems in time and frequency domains, includes block diagrams and PID controllers using Matlab and Simulink virtual experiment techniques.

1. *Course number and name:*
   ME 423: Acoustics and Noise Control

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Turgay Bengisu

4. *Text book title, author, and year:*
   - ***Fundamentals of Acoustics,*** 4th edn., by Lawrence E. Kinsler, Austin R. Frey, Alan B. Coppens and James V. Sanders, John Wiley & Sons, 1962. ISBN # 0-471-84789-5

   a. *Other supplemental materials:*
   - ***Industrial Noise and Vibration Control,*** by J. D. Erwin and E. R Graf, Prentice Hall, Inc., 1979. ISBN # 0-13-461574-3

5. *Specific course information:*

   a. *Brief description of the content of the course (catalog description):*
   Introduction to vibrations and waves; plane and spherical acoustic waves; sound generation, transmission and propagation; sound intensity and power; principles and definitions of noise control; sound and hearing; hearing conservation; community, building and industrial noise control; measurement of sound. Generally offered winter.

   b. *Prerequisites or co-requisites:*
   Prerequisites: ME 322, MTH 254, APM 255 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
   Elective course for ME seniors.

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - Use solutions of plane and spherical wave equations to solve simple boundary value problems of acoustic radiation. (a, b, e, k)
   - Be able design simple acoustics resonators and filters. (a, b, c, e, k)
   - Be able to assess impact environmental noise on hearing and determine work place compliance with various noise criteria. (a, d, g, k)
   - Be able to design acoustic enclosures, walls and absorptive treatments in industrial work environment. (a, b, c, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, d, e, g, k.

7. *Brief list of topics to be covered:*
   - Derivation of acoustic wave equation.
   - Solutions of wave equation in one and three dimensions.
   - Plane waves: Energy density, acoustic intensity and specific acoustic impedance.
   - Spherical waves: Energy density, acoustic intensity and specific acoustic impedance.
   - Radiation from pulsating sphere, line source and piston sources.
   - Radiation impedance.
   - Acoustic modes of rectangular cavities.
   - Propagation in waveguides of constant cross section.
   - Standing waves, branching, absorption, reflection and transmission in pipes.
   - Power radiation from ends of pipes.
   - Acoustic filters and resonators.
   - Noise levels and decibel scale, octave bands, common level references and weightings. Decibel arithmetic.
   - Psychological effects noise
     - Loudness
     - Perceived noise
     - Noise criteria
     - Sound levels (A, B, C)
     - Speech interference level
   - Noise control criteria
     - Noise dose and OSHA regulations.
     - Performance indices for environmental noise.
   - Noise control techniques
     - Room acoustics.
     - Noise control by walls, enclosures and barriers.

1. *Course number and name:*
   ME 438: Fluid Transport

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Laila Guessous, Associate Professor of Engineering

4. *Text book title, author, and year:*
   - Fox and McDonald's Introduction to Fluid Mechanics, P.J. Pritchard, 8th edition, John Wiley & Sons, 2011

   a. *Other supplemental materials:*
   Extensive course notes and handouts

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
   Continued study of the fundamentals of fluid mechanics and their applications, angular momentum principle; generalized study of turbo machines, potential flow of inviscid fluids, laminar and turbulent boundary layer theory, dimensional analysis and similitude, compressible flow. With laboratory. Generally offered fall.

   b. *Prerequisites or co-requisites:*
   Prerequisites: ME 331 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
   Elective course

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - Design and perform experiments. Analyze experimental data and write technical reports. (a, b, d, e, f, g, k)
   - Explain and apply the Conservation of Momentum principle, both linear and angular formulations, to model fluid flow and its forces on simple control volumes. (a, e, k)
   - Apply principles of dimensional analysis and similitude to specify the dimensionless parameters that characterize a fluid flow problem; determine appropriate scaling parameters so that model performance can be used to predict prototype performance. (a, e, k)
   - Explain and apply appropriate fundamental principles to model the performance of turbomachines. (a, e, k)

- Define or explain some of the basic concepts associated with viscous boundary layers, such as pressure gradient, displacement and momentum thicknesses, flow separation, and skin friction. (a, e)
- Explain the fundamental concepts of aerodynamic drag; determine drag and lift forces for bodies in external flow. (a, e)
- Define or explain some of the basic concepts associated with compressible flow, such as stagnation conditions, mach number, subsonic & supersonic flow, and shocks. (a, e)
- Apply appropriate fundamental principles to model the one-dimensional compressible flow in a duct including area change, friction, heat and normal shocks. (a, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, d, e, f, g, k

7. *Brief list of topics to be covered:*
   - Introduction; Review of basic concepts in Fluid Mechanics
   - Integral Analysis - Conservation of Mass & Linear Momentum
   - Integral Analysis – Rectilinear Acceleration & Angular Momentum
   - Differential analysis of fluid motion; Exact solutions of laminar flow
   - Dimensional Analysis and Similitude
   - Turbomachinery
   - Viscous boundary layer theory; Boundary layer solutions
   - Drag, Lift, Flow separation
   - Compressible Flow: Isentropic flow, duct flow with friction and heat, normal shocks (time permitting)

1. *Course number and name:*
   ME 443 – Polymeric Materials

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   J. David Schall, Assistant Professor of Engineering

4. *Text book title, author, and year:*
   A. Brent Armstrong, "Plastics Materials & Processing", Pearson Prentice Hall, Third Edition 2006, ISBN 0-13-114558-4
   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Terminology and nomenclature for plastics. General topics dealing with plastics, such as structure, morphology, properties, etc. Focus on mechanical and physical properties and mechanical behavior of plastics. Technology related to plastics processing, testing, designing and recycling is introduced. Generally offered winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 372 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective course

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*

By the end of the course, successful students will be able to:

- To introduce common scientific and technical terms used in the field of polymeric materials (a,e)
- To study polymer formation and manufacturing processes. (a,e,k)
- To study the structure and properties of polymeric materials, e.g. molecular structure, solid structure, mechanical properties, thermal properties, rheological properties, optical properties, and physical states & transitions. (a,e)
- To investigate polymer degradation and stabilization and polymer recycling.(a,e,h,j)
- To understand common plastics technology, such as compounding, processing, testing, and designing.(a,e,k)

   a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*

Course addresses ABET Student Outcome(s): a, e, h, j, k

7. *Brief list of topics to be covered:*
   - Synthesis of addition and condensation polymers.
   - Molecular weight distribution
   - Characterization of polymeric materials
   - Physical and chemical properties of polymers, mechanical properties
   - Processing
   - Recycling
   - Applications
   - Commodity plastics.

1. *Course number and name:*
   ME 448: Thermal Energy Transport

2. *Credits and contact hours:*
   4 credits hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Chris Kobus, Associate professor of Engineering

4. *Text book title, author, and year:*
   - Introduction to Heat Transfer, Fifth Edition, F.P. Incropera and D.P. DeWitt, Wiley, 2005

   a. *Other supplemental materials:*
      None.

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Continued study of properties and descriptions of conduction, convection and thermal radiation heat transfer; thermal boundary layer theory; forced and natural convection, heat transfer correlations. Thermodynamics of thermal radiation, radiation intensity, surface properties and energy exchange. Laboratory emphasizes experimental design and development of empirical relationships. Generally offered winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 331 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program Required*
      Elective for the Mechanical Engineering program

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - List and describe elementary terminology associated with thermal transport phenomena, including the concepts of a thermodynamic system, a thermodynamic property, dimensionless correlations, thermal radiation intensity, radiation surface properties, boundary layer theory, and forced and natural convective heat transfer. (a, e, k)
   - Design and perform experiments. Formulate, evaluate, and calculate experimental uncertainties of indirect measurements. Analyze experimental data and write technical reports. (a, e, k)
   - Apply the conservation of mass and energy and the momentum principle to obtain solutions for the convective heart transfer coefficient for forced or natural convection

along a flat plate; boundary layer theory. Be able to non-dimensionalize the heat transfer coefficient in terms of appropriate dimensionless numbers such as Nusselt number, Prandtl number, Reynold's number and the Grashoff and Rayleigh number. (a, e, k)

- Be able to develop and use dimensionless correlations and property relationships in solving problems associated with both forced and natural convection. (a, e, k)
- Apply the conservation of energy obtain solutions for the convective heart dissipation for straight (pin fin) of tapered extended surfaces (optimal fin). List basic fin quantities, such as heat dissipation, effectiveness, efficiency and material utilization factor. (a, e, k)
- Apply appropriate definitions and models associated with radiation heat transfer, such as the definition of thermal radiation, monochromatic intensity of radiation, monochromatic or total emissive poser, Stefan-Boltzman model to develop expressions for radiative heat transfer. (a, e, k)
- Apply the definition of the configuration or shape factor to solve problems involving radiative heat exchange between black or gray surfaces, such as solar radiation, radiation heat shielding and a thermos. (a, e, k)

a. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:
Course addresses ABET Student Outcome(s): a, e, k

7. *Brief list of topics to be covered:*
   - Review of basic heat transfer modes
   - Thermal boundary layer theory; inviscid and vicous flows
   - Viscous boundary layer theory
   - Modeling the convective heat transfer coefficient in boundary layer theory
   - Boundary layer theory solutions and applications
   - Extended surfaces
   - Optimal design of cooling fins
   - Introduction to radiation heat transfer; microscopic and macroscopic mechanisms
   - Stefan-Boltzmann model
   - Configuration factor
   - Radiation exchange between surfaces
   - Application; modeling the global average annual temperature, radiation heat shields

1. *Course number and name:*
   ME 454: Alternative Energy Systems

2. *Credits and contact hours:*
   4 credits hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Chris Kobus, Associate professor of Engineering

4. *Text book title, author, and year:*
   - Renewable Energy, Second Edition, Godfrey Boyle, Oxford University Press, 2004

   a. *Other supplemental materials:*
      None.

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      The analysis and design of alternative energy conversion systems. Primary topics include biomass energy conversion, including biofuels, solar and wind power will be primary topics. Other topics include fuel cells, geothermal energy and hydroelectric power. With project. Generally offered winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 331 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program Required*
      Elective for the Mechanical Engineering program

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - List and describe elementary terminology associated with fluid and thermal transport phenomena, including the concepts of a thermodynamic system, a thermodynamic property, dimensionless correlations, thermal resistance, overall heat transfer coefficient, and forced and natural convective heat transfer. (a, e, k)
   - Apply the conservation of mass and energy and the momentum principle, in addition to constitutive relations, to obtain solutions for the problems associated with alternative energy systems and conversion processes. (a, e, k)
   - Be able to describe the thermal characteristics of an occupant envelope (residential, industrial, municipal or commercial building), and model the energy needs of such enclosures. Be able to account for thermal energy loading and transfer. (a, e, k)

- Be able to describe the fundamental principles governing lift on a wind turbine blade, hydroelectric power generation, geo- and ocean-thermal energy conversion, Rankine cycle solar power generation, and biomass energy conversion. (a, e, k)
- Explain the origins and history of wind power, and model the power produced in typical modern wind turbines (a, e, k)
- Be able to explain the pros and cons of the various alternative energy systems qualitatively on a life cycle cost analysis basis including conservation. (a, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a,e,k

7. *Brief list of topics to be covered:*
   - Review of basic thermodynamics, fluid mechanics and heat transfer modes
   - Conservation in enclosures; residential, industrial, commercial
   - Modeling energy requirements in enclosures
   - Thermal loading
   - Thermal resistance networks
   - Backing out overall heat transfer coefficients in enclosures from usage data; summer cooling, winter heating
   - Wind power; modeling, utilization, government policy and economic feasibility
   - Gethermal heating/cooling
   - Geothermal power generation
   - Biomass heating
   - Biodiesel and ethanol production

1. *Course number and name:*
   ME 456: Energy Systems Analysis and Design

2. *Credits and contact hours:*
   4 credits hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Brian Sangeorzan, Professor of Engineering

4. *Text book title, author, and year:*
   Fundamentals of Engineering Thermodynamics, M.J. Moran, H.N. Shapiro, D.D. Boettner, and M.B. Bailey, 2011, Wiley 7th Ed.
   a. *Other supplemental materials:*
      - Extensive course notes and handouts

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      The analysis and design of thermodynamic systems. Applications include thermodynamic cycles for power; thermodynamics of non-reacting mixtures including psychrometry; concepts of available energy and application to process/system optimization; the thermodynamics of reacting mixtures, including chemical equilibrium concepts, applied to combustion systems. With project. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: EGR 250 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Mechanical engineering majors are required to select either ME 456 or ME 482, and also may be taken as an elective.

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, students should be able to aply the 1st and 2nd Laws of Thermodynamics to design and analyze thermodyamic systems. Specifically, the successful student should be able to:
   - Apply the 1st and 2nd Laws of Thermodynamics in the analysis and/or design of power cycles such as the Rankine, Otto, Diesel and Brayton cycles. (a, c, d, e, f, g, i, j, k)
   - Apply the 1st and 2nd Laws of Thermodynamics in the analysis and/or design of thermodyamic systems involving simple non-reacting mixtures and air-water vapor mixtures (psychrometry). (a, c, d, e, f, g, i, j, k)

- Apply the 1st and 2nd Laws of Thermodynamics in the analysis of simple systems involving reacting mixtures; determine heating values, adiabatic flame temperature and entropy produced during a chemical reaction (a, c, d, e,).

- Apply Exergy concepts in the analysis of simple thermal systems and devices; calculate maximum possible work, exergy destroyed. (a, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a,c, d, e, f, g, i, j, k

7. *Brief list of topics to be covered:*
   - Review: First Law, Properties of pure substances, Second Law, Property Relationships
   - Power Cycles: Rankine Cycle; Brayton Cycle, Otto and Diesel Cycles
   - Other Power Cycles
   - Ideal, Non-Reacting Mixtures
   - Psychrometry
   - Reacting Mixtures: Stoichometry and 1st Law Analysis
   - Second Law Analysis of Reacting Mixtures
   - Exergy; Control Mass & Control Volume Exergy Analysis
   - Exergy Applications
   - Analysis/Design Project

1. *Course number and name:*
   ME 457: Internal Combustion Engines I

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Brian Sangeorzan, Professor of Engineering

4. *Text book title, author, and year:*
   - Internal Combustion Engines I, A.C. Alkidas (Instructor's course notes)

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   b. *Brief description of the content of the course (catalog description):*
      Introduction to thermodynamics, fluid mechanics and performance of internal combustion engines including: introduction to engine types and their operation, engine design and operating parameters, ideal thermodynamic cycles, thermodynamics of actual working fluids and actual cycles, gas exchange processes, heat losses, performance, exhaust gas analysis and air pollution. Offered fall.
      Prerequisite(s): ME 331 and major standing.

   c. *Prerequisites or co-requisites:*
      Prerequisite(s): ME 331 and major standing.

   d. *Indicate whether a required, elective, or selected elective course in the program*
      Elective

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - Define the various parameters that characterize the geometry and performance of internal-combustion engines **(a, e),**
   - Compute internal combustion engine cycle performance, and compare and discuss the merits of the various operating cycles of the internal-combustion engines. **(a, e, j, k),**
   - List and describe the pertinent properties of gasoline and diesel fuels. **(a, e, h, j, k),**
   - Apply chemical-element mass balance and chemical equilibrium assumptions to calculate the exhaust-gas species concentrations for lean, stoichiometric, rich combustible mixtures. **(a, e, k),**
   - Discuss and demonstrate how one applies the First-Law of Thermodynamics and pertinent engine measurements to perform an engine energy balance. **(a, e),**

- Discuss the factors, which influence the gas exchange processes in a 4-stroke engine. Based on flow measurements, compute the Mach Index for the intake flow, and show how it correlates with volumetric efficiency of the engine. **(a, e, k),**
- Explain the influence of in-cylinder motion on engine performance, discuss the gross characteristic velocities of the in-cylinder flow, and show how these velocities vary with crank angle. **(a, e),**

e. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
Course addresses ABET Student Outcome(s): a, e, h, j, k

7. *Brief list of topics to be covered:*

- Introductory Concepts: Engine Classifications.
- Operating Cycles. Kinematics of the Piston Reciprocating Motion.
- Engine Operating and Performance Parameters.
- Review of Classical Thermodynamics.
- Ideal Air Cycles (Ideal Limited-Pressure Cycle. Otto Cycle. Diesel Cycle. Atkinson & Miller Cycle). Ideal 4-Stroke Spark- Ignition Cycle. Fuel-Air Cycles. Real Engine Cycles.
- Mixture Thermodynamics and Thermochemistry of Fuel-Air Mixtures: Properties of Non-Reacting Mixture of Gases. Properties of Gasoline and Diesel Fuels.
- Combustion Stoichiometry. Exhaust Gas Composition. First-Law Analysis of Reactive Mixtures (Engine Energy Balance). Chemical Equilibrium (In-Cylinder Species Decomposition).
- Flows: Intake and Exhaust Flows (Volumetric Efficiency, Gas Exchange Processes in a 4-Stroke Engine, Flows through Valves (Mach Index), Tuning of Intake and Exhaust Systems (Reflective-Wave and Helmholtz-Resonator theories)). In-Cylinder Motion (Swirl and Tumble Motion, Squish Velocity)

1. *Course number and name:*
   ME461: Analysis and Design of Mechanical Structure

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   K. Li, Ph.D., Professor of Engineering

4. *Text book title, author, and year:*
   - Richard G. Budynas, Advanced Strength and Applied Stress Analysis, Second Edition, McGraw-Hill Companies, 1999, ISBN 0-07-008985-X.

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Methods of advanced mechanics of materials applied to the design of mechanical structures. Topics include stress and strain analysis, force equilibrium, deformation compatibility, torsion of non-circular cross-sections, torsion of thick-walled tubes, shear centers, non- symmetric bending, curved and composite beam and thick-walled tubes, shear centers, non-symmetric binding, curved and composite beams and thick-walled cylinders. Generally offered fall.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 361 and major standing

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective of engineering and required of bio-engineering majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - Apply theories of advanced mechanics and methods of stress/strain/energy to design/analyze mechanical structures. (a, c, d, e)
   - Apply failure, fracture and fatigue theories to design mechanical systems. (a, c, d, e, k)
   - Identify, formulate and solve safety problems. (e, h, j)
   - Determine torsional stresses and deformation in thin-walled tubes and bars with noncircular multiple connected cross sections. (a, e, k)
   - Determine bending and shear centers of symmetrical and nonsymmetrical beams, and calculate deflections of beams. (a, e, k)
   - Determine stresses and deflections of curved beams. (a, e, k)

- Use experimental stress analysis methods and finite element method to solve stress-strain problems, (b, c, d, f, h, i, j, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, d, e, f, h, i, j, k

7. *Brief list of topics to be covered:*
   - Fundamental Concepts
   - Advanced Mechanics Subjects
   - Energy Method
   - Design Considerations
   - Experimental Stress Analysis
   - Introduction to Finite Element Method

1. *Course number and name:*
   ME 467: Optical Measurement and Quality Inspection

2. *Credits and contact hours:*
   4 credits hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Lian X. Yang, Professor of Engineering

4. *Text book title, author, and year:*
   No textbook will be used. Lectures will be based on handouts, notes and materials extracted from scientific journals. However, the following two books are recommended for reference:
   - "Optical Methods of Engineering Analysis", by Gary Cloud, Cambridge University Press 1998, ISBN 0-521-63642-6
   - "Digital Shearography – Theory and Application of Digital Speckle Pattern Interferometry", By Wolfgang Steinchen, Lianxiang Yang, SPIE Press 2003, Bellingham, Washington USA, ISBN 0-8194-4110-4

   a. *Other supplemental materials:*
      - Relevant research papers

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Topics include the state-of-the art optical methods such as holography, shearography, digital image correlation, three-dimensional computer vision, electronic speckle pattern interferometry and laser triangulation; with applications to measurement of displacement, vibrational mode shapes, material properties, residual stresses, three-dimensional shapes, quality inspection and nondestructive testing. With laboratory. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 361 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective course

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - List and describe relevant professional terminology related to optical measurement and quality inspection. (a, e, f, h)
   - Explain the laser triangulation technique and its applications in engineering. (a, b, e, j)

- Explain the principle of three-dimensional computer vision and applications in engineering. (a, b, e, j)
- Explain the principle of digital holography/Electronic Speckle Pattern Interferometry - ESPI and its applications in engineering. (a, b, e, j)
- Explain the principle of digital shearography and its applications in engineering. (a, b, e, j)
- Explain the principle of digital image correlation technique and its applications in engineering. (a, b, e, j)
- Introduce the principles of ultrasonic and X-Ray techniques for nondestructive testing. (a, e, h, j)
- Design and perform experiments. Evaluate and analyze experimental results and write technical reports. (a, b, d, e, f, g, I, k)
- Apply these techniques to analyze and solve engineering problems, train how to do research through conducting a term project (a, b, d, e, f, g, h, i, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, d, e, f, g, h, i, j, k

7. *Brief list of topics to be covered:*
   - Introduction: Applications of optical measurement and inspection techniques for deformation/strain measurement, nondestructive testing, 3D contouring, vibration measurement (with demo)
   - Basic concepts in optics: Reflection & refraction, lenses, imaging systems, laser, wave theory and interference (with demo)
   - Basic concept in mechanics: deformation, strain, relations between strain & stress,
   - Fundamental of laser triangulation, application for measuring out-of-plane displacement and 3D contour (with lab)
   - Fundamental of 3D-computer vision, system calibration, application for whole field 3D shape measurement and for surface distortion measurement (with demo and lab)
   - Fundamental of digital image correlation, application for 3D shape, displacement, and stain measurement (with demo)
   - Principles of digital holography/ESPI, fundamental of phase shift technique, application for measuring deformation in micro level, application for vibration measurement (with demo and lab)
   - Principles of digital shearography, applications for strain measurement and nondestructive testing (with demo and lab)
   - Introduce the principles of ultrasonic and X-Ray techniques for nondestructive testing
   - Term project including: form a group (4-5 persons); choose a project (such as strain measurement on a selected specimen); study a few papers on the subject; plan the laboratory setup and determine the equipment needs; prepare the needed fixture etc; perform the experiments and analyze the experimental results; write a technical group report; and give a 15-minutes group presentation.

1. *Course number and name:*

ME 472 – Materials Properties and Processes

2. *Credits and contact hours:*

4 credits hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Gary Barber, Professor
   J. David Schall, Assistant Professor of Engineering

4. *Text book title, author, and year:*
   Meyers and Chawla "Mechanical Behavior of Materials" Cambridge, ISBN 978-0-521-86675-0 (2009)
   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
   Study of mechanical behavior of real engineering materials and how they influence mechanical design. True stress/strain properties of materials, plastic deformation and fracture of materials, failure theories, fatigue damage under cyclic loading, creep and high temperature applications. Material properties of engineering metals, ceramics and composites. Behavior of materials during and after manufacturing processes such as stamping, drawing, extrusion, etc. Generally offered winter.

   b. *Prerequisites or co-requisites:*
   Prerequisites: ME 361, ME 372 and major standing.
   .

   c. *Indicate whether a required, elective, or selected elective course in the program*
   Elective course

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*

- Explain true strain and strain energy and apply classic plasticity theory.(a,e)
- Describe microstructures of single crystals and polycrystals.(a,e)
- Use dislocation theory and dislocation energy to study plastic deformation of materials.(a,e)
- Apply fracture mechanics.(a,e)
- Analyze fatigue failure and design under cyclic loading.(a,e)
- Analyze fundamentals of manufacturing processes.(a,e)
- Critique one or more papers related to Materials Properties and Engineering.(g,h)

By the end of the course, successful students will be able to:

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, e, g, h

7. *Brief list of topics to be covered:*
   Materials structure, properties, and performance
   Elasticity and viscoelasticity
   Plasticity
   Materials imperfections: Point defects, dislocations, grain boundaries
   Work hardening
   Macro and Microscopic aspects of fracture
   Solid solution precipitation hardening
   Creep
   Fatigue
   Applications in metal forming

1. *Course number and name:*
   ISE 484/ME 473 - Flexible and Lean Manufacturing Systems

2. *Credits and contact hours:*
   4 credits, 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Robert Van Til, Professor of Engineering

4. *Text book title, author, and year:*
   - *Computer-Aided Manufacturing*, C.T. Chang, R.A. Wysk and H.P. Wang, 3rd edition, Prentice-Hall, 2005 (ISBN 0-13-142919-1).

5. *Specific course information:*

   a. *Brief description of the content of the course (catalog description):*
   The components of flexible manufacturing systems (FMS): CNC machining centers, automated assembly, automated warehousing (AS/RS), inspection, material transport, programmable logic controllers and coordination; integration of CAD/CAM to the FMS; production planning and control; factory simulation; implementation strategies. With laboratory. Generally offered winter.

   b. Prerequisites or co-requisites:
   Prerequisite: Major standing.

   f. Indicate whether a required, elective, or selected elective course in the program
   Elective course

6. *Specific goals for the course*
   a. Course Objectives: *(letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   1. Illustrate the proper application of manufacturing safety procedures while working in the S. & R. Sharf CIM Laboratory (f)
   2. Calculate performance measures for the steady-state flow of parts through a simple production system (a, e, k)
   3. Define the terms of lean manufacturing and apply basic lean manufacturing tools (a, e, k)
   4. Define the terms of Group Technology (GT) and apply GT concepts in a flexible manufacturing environment (a, e, k)
   5. Discuss the operation and application of robotic systems in a manufacturing environment; safely operate an industrial robot using its teach pendant; write and edit a robot application program (a, b, c, d, e, f, k)
   6. Define the terms and applications of material transport systems and Automated Storage/Retrieval Systems (AS/RS) in a manufacturing environment (a, e, k)

7. Define the terms of Programmable Logic Controllers (PLC) and apply the various programming techniques; write and debug a PLC ladder logic programs using a PLC simulator (a, b, c, d, e, k)
8. Define the terms and applications of two-dimensional vision systems in the manufacturing environment; solve an object identification problem using an industrial vision system (a, b, c, d, e, k)
9. Identify various types of sensors used in the manufacturing environment and describe their use (a, e)
10. Define geometric dimensioning and tolerancing (a, e, k)
11. Define the terms involved in Computer Numerically Controlled (CNC) manufacturing systems; write and edit basic CNC programs for a CNC mill or a CNC lathe (a, e, k)
12. Define Computer Aided Manufacturing (CAM) systems and their relationship to Computer-Aided Design (CAD) and CNC systems; write and debug a CNC mill or CNC lathe program using a CAM system (a, b, c, d, e, k)

b. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*

Course addresses ABET Student Outcome(s): a, b, c, d, e, f, k

7. *Brief list of topics to be covered*

- Overview of the manufacturing environment
- Introduction to flexible manufacturing systems
- Laboratory safety
- Modeling and performance of production systems
- Line balancing
- Introduction to lean manufacturing
- Value stream mapping
- Group technology
- Robotics - terms and definitions
- Review of linear transform theory
- Application of linear transform theory to robotics
- Robotic task planning
- Overview of robot programming languages
- Programmable Logic Controllers (PLC)
- PLC programming using flow charts and sequential function charts
- material transport and storage
- Vision systems
- sensors
- Overview of manufacturing processes
- Computer Numerically Controlled (CNC) manufacturing systems
- Overview of Computer-Aided Manufacturing (CAM)

1. *Course number and name:*
   ME 474: Manufacturing Processes

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Gary Barber, Professor of Engineering

4. *Text book title, author, and year:*
   Manufacturing Processes for Engineering Materials, Serope Kalpakjian and Steven Schmid, 2008
   a. *Other supplemental materials:*
      None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Fundamentals and technology of machining, forming, casting and welding. Mechanics of cutting. Molding of polymers. Tolerancing and surface topography. Manufacturing considerations in design. Economics of manufacturing. Process assembly and product engineering. Lab to be arranged. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 372 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - Explain basic mechanical behaviors of engineering materials and their importance in manufacturing process selection. (a, e, k)
   - Describe common types of structure in metal alloys and interpret the influence of manufacturing sequences on the structure development in metal alloys. (a, e, k)
   - State the scope of tribology and the importance of surface engineering in manufacturing. (a, e, k)
   - List and describe various machining processes, e.g., turning, milling, grinding, etc. Calculate cutting parameters such as cutting forces, cutting energy and cutting velocity. (a, e, k)
   - Describe casting processes involving either expendable molds or permanent molds. Tell the difference of these casting processes in terms of process characteristics, applications and economics. (a, e, k)

- 6. List and describe various bulk and sheet forming processes. Carry out stress and strain analyses for basic forming processes such as forging, extrusion, wire drawing, etc. (a, e, k)
- Describe characteristics of welding processes and interpret the effect of welding on microstructures and mechanical properties. (a, e, k)
- Explain the difference in manufacturing metal alloys and polymeric materials. Know unique mechanical properties of polymers and fundamental polymer processing methods. (a, e, k)
- State methods used to process metallic powders and ceramic powders. Calculate the sintering force using surface tension. (a, e, k)
- Identify the importance of modern computers in manufacturing and state a variety of applications in which computer integrated systems will benefit manufacturing processes. (a, e, k)
- Define the key concepts, terminologies, and benefits of Lean Manufacturing. (a, e, k)
- Plan and design a manufacturing process layout for a product, taking into account cost, productivity, geometrical complexity, and process capability. (c, d, g)
- Design and perform an experimental study for a manufacturing process using Design of Experiments and analyze the process using Statistical Quality Control. (b, g)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s):
   a, b, c, d, e, g, k

7. *Brief list of topics to be covered:*
   Mechanical behavior of materials, Properties of Metals, Surfaces, Tribology, Casting, Metal Forming, Cutting processes, Grinding, Properties of polymers, Joining, Manufacturing economics, Process selection, Value engineering.

1. *Course number and name:*
   ME 475 - Lubrication, Friction and Wear

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Qian Zou, Associate Professor of Engineering

4. *Text book title, author, and year:*
   - Class Notes.
   - Recommended book: Introduction to Tribology, by Bharat Bhushan, John Wiley & Sons, 2002.

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Study of fundamental wear mechanisms including: adhesive, abrasive, corrosive and surface fatigue; boundary and hydrodynamic lubrication; friction theories; surface topography characterization. Applications: journal and ball bearings, gears and engine components. Generally offered fall.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 372 and major standing.
      Prerequisite or corequisite: ME 331.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective of mechanical engineering major

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - Describe how surface topography is measured and the effect of surface roughness on component performance. (a,e)
   - Describe a graphical model for stick-slip behavior and utilize the model to determine solutions to minimize stick-slip in practical applications. (a,e)
   - Identify the fundamental causes of friction and explain how apparent area of contact and real area of contact affect friction. (a,e,h,j)
   - Distinguish between abrasive, adhesive, corrosive and surface fatigue wear. Explain philosophies used to simulate wear in the laboratory. (a,e)

- Determine the lamda ratio to see if a component is operating in the boundary, mixed or hydrodynamic lubrication regime. List methods to determine oil viscosity and oil quality. Explain the role of oil additives in lubricants. Explain how the Reynolds equation is used to solve for variables such as coefficient of friction and oil film thickness in sliding components. (a,e)
- Select and design journal bearings. Select roller bearings. (a,e)
- Calculate time for squeeze action to occur. (a,e)
- Calculate friction torque and load carrying ability of a hydrostatic bearing. Optimize a hydrostatic bearing in the basis of load carrying ability. (a,e)
- Derive equations for frictional torque in clutches. Calculate braking time. (a,e)
- Locate, analyze and critique technical papers related to tribology. (a,f,g,k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, e, f, g, h, j, k

7. *Brief list of topics to be covered:*
   - Introduction to Tribology
   - Surface Topography: Characterization with Surface Roughness Parameters; Measurement of Surface Roughness; Effect of Surface Roughness on Component Performance
   - Friction: Fundamental of Friction; Static Friction vs. Kinetic Friction; Basic Mechanisms of Sliding Friction; Stick-slip Behavior; Friction in Vacuum Environment; Rolling Friction
   - Wear: Wear Mechanisms; Wear Process; Measurement of Wear; Laboratory Simulation of Wear
   - Lubrication: Oil Viscosity; Lubrication Regimes; Hydrostatic Lubrication; Hydrodynamic Lubrication; Elasto-hydrodynamic Lubrication; Mixed Lubrication; Boundary Lubrication; Squeeze Film Lubrication; Role of Oil Additives
   - Tribological Components and Applications: Journal Bearings; Roller Bearings; Clutches and Brakes; Engines
   - Micro/nanotribology: Introduction of Micro/nanotribology; Micro-friction; Micro-wear; Molecular Films; Molecular Dynamics Simulation

1. *Course number and name:*
   ISE 422/ME 478 - Robotic Systems

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Robert Van Til, Professor of Engineering

4. *Text book title, author, and year:*
   - Robot Modeling and Kinematics, R. Manseur , Da Vinci Engineering Press, 2006 (ISBN 1-58450-851-5).

   a. *Other supplemental materials:*
      - None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Overview of industrial robotic manipulators, their components and typical applications. Kinematics of robots and solution of kinematic equations.
      Trajectory planning and the Jacobian matrix. Robot programming languages and task planning. Laboratory experience in the development and implementation of a kinematic controller using a reconfigurable industrial manipulator. Demonstrations and application using industrial robots. Generally offered fall.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 322 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective course

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   1. Define the basic operating principles of a robotic manipulator as well as its classification and applications (a, e, k)
   2. Safely operate an industrial robot and program it to complete a specified task (b, d, f)
   3. Apply linear transformation theory to model three-dimensional displacement and rotation (a, e, k)
   4. Define and apply the Denavit-Hartenberg model to an open kinematic linkage (a, b, d, e, k)
   5. Derive and program the forward, or direct, kinematic solution of a robotic manipulator (a, b, c, d, e, k)

6. Derive and program the reverse, or inverse, kinematic solution of a robotic manipulator (a, b, c, d, e, k)
7. Determine the singular points of a robotic manipulator (a, e, k)
8. Construct a trajectory planning algorithm for a robotic manipulator in joint space (a, e, k)
9. Construct a robotic manipulator's Jacobian matrix and use it to for trajectory planning in Cartesian space (a, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, d, e, f, k

7. *Brief list of topics to be covered:*

- Review of linear algebra
- Robotics - terms and definitions
- Overview of industrial robotics
- Laboratory safety
- Overview of robot programming
- Linear transformation theory
- Relative and absolute transforms
- Homogeneous transforms
- Forward kinematic solution and Denavit-Hartenberg rules
- Kinematics of robots with prismatic links
- Euler angles and roll, pitch, yaw angles
- Reverse solution for a robotic manipulator
- Singular points and redundant robots
- Trajectory planning
    - Joint space
    - Cartesian space
- Overview of robot dynamics

1. *Course number and name:*
   ME 479: Fundamentals of Nuclear Engineering

2. *Credits and contact hours:*
   3 credits hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Chris Kobus, Associate Professor of Engineering

4. *Text book title, author, and year:*
   - Introduction to Nuclear Engineering, Third Edition, Lamarsh and Baratta, Prentice Hall, 2001

   a. *Other supplemental materials:*
      None.

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Fundamental concepts of atomic and nuclear physics; interaction of radiation with matter; nuclear reactors and nuclear power; neutron diffusion and moderation; heat removal from nuclear reactors; radiation protection and shielding; reactor licensing, safety and the environment; applications in power generation and medicine. Generally offered fall.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 331, 372 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program Required*
      Elective for the Mechanical Engineering program

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - Explain the conservation principles in nuclear physics (charge, nucleons, momentum and energy) and apply the Conservation of Momentum and Conservation of Energy principles to systems of particles. (a, e, k)
   - Explain basic atomic structures and radiation types, and its interaction with matter including scattering, particle capture and rejection, decay chains and half-life. (a, e, k)
   - Explain concepts of nuclear fission including critical energy, fissionable versus fissile material, fertile material, transmutation, and instantaneous versus decay energy. (a, e, k)
   - Explain nuclear terminology, including cross-section of absorption and scattering. (a, e, k)

- Explain and apply principles of neutron physics, including neutron moderation and reaction rates, moderator ratio, prompt versus delay neutrons, neutron generation time, and neutron life cycle, on reactor criticality and reactivity. (a, e, k)
- Explain neutron poisons both intended by design and resulting from natural processes. (a, e, k)
- Explain in detail how electrical power is generated from nuclear energy. (a, e, k)
- Explain the differences in the various reactor designs past, present and future. (a, e, k)
- Identify and explain the major nuclear incidents that have occurred in the nuclear power industry and how each event changed the way the industry functions. (a, e, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
Course addresses ABET Student Outcome(s): a, e, k

7. *Brief list of topics to be covered:*
   - Review of atomic physics
   - Conservation principles in nuclear and conventional reactions
   - Radiation types; particle and electromagnetic
   - Radiation interaction with matter; radiation shielding
   - Scattering; elastic and inelastic; conservation of momentum analysis
   - Absorption and absorption cross-section
   - Decay chains
   - Nuclear fission; fissionable, fertile and fissile material
   - Neutron physics
   - Neutron poisons
   - Reactor designs
   - Major nuclear events

1. *Course number and name:*
   ME 480: Nuclear Reactors and Power Plants

2. *Credits and contact hours:*
   3 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Brian Sangeorzan, Professor of Engineering

4. *Text book title, author, and year:*
   Kam W. Li, A. Paul Priddy, John Wiley & Sons, 1985

   a. *Other supplemental materials:*
      Class handouts, DTE training materials, online materials

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      The study of various nuclear power plant types and systems; Rankine Cycle thermodynamics; BWR, ESBWR and PWR power plants; engineered safety systems; nuclear regulations, codes and standards; reactor safety fundamentals; economic and environmental issues. Generally offered winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 456, ME 479, and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required of engineering and engineering science majors

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - Describe the various types of nuclear reactors and power plants, and discuss the advantages of each design. (c, f, h, j),
   - Describe and explain the boiling water reactor and BWR power plant systems (c, f, h, i, j),
   - Apply the 1st and 2nd Laws of Thermodynamics in the analysis of a Rankine cycle power plant. (a, e, k)
   - Explain the operation of BWR systems, including engineered safety systems and plant control (c, f, h, i, j),
   - Describe and explain the pressurized water reactor and PWR power plant systems (c, f, h, i, j),
   - Explain the operation of PWR systems, including engineered safety systems and plant control (c, f, h, i, j),

- List the responsibilites of the NRC and identify where the rules of the NRC are published (c, f, h, i, j),
- Explain the role of Title 10 of the U.S. Code of Federal Regulations and the purpose of some of the Nuclear Regulatory documents (c, f, h, i, j),
- Explain the role of the INPO (c, f, h, i, j),
- Discuss some of the economics of nuclear power (c, f, h, i, j),
- Identify and explain some of the environmental issues associated with nuclear power generation (c, f, h, i, j),
- Report on the specifics of a sub-system or engineered safety system for one power plant type (c, f, h, j)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, c, e, f, h, i, j, k

7. *Brief list of topics to be covered:*
   - Thermodynamic aspect of Nuclear Power Cycles – Rankine Cycle
   - Effects of Superheat, Reheat, Regeneration
   - Types of power plants in operation in the U.S and abroad – advantages and disadvantages; Current license applications
   - Boiling Water Reactors - Systems and plant control
   - Evaporative Cooling Towers
   - Condensers
   - The ESBWR – overview of system and passive safety systems
   - Pressurized Water Reactors - Steam generators and superheaters
   - PWR turbines and plant control
   - Engineered Safety Systems –systems and components
   - Gas Turbines, Combined Cycles, Co-Generation
   - Nuclear Regulations, Codes and Standards
   - Reactor Safety Fundamentals - Safety Approach/Philosphy, accident consequences, Risk Assessment
   - Nuclear Power Economics
   - Environmental Issues

1. *Course number and name:*
   ME 482: Fluid and Thermal System Design

2. *Credits and contact hours:*
   4 credits hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Chris Kobus, Associate Professor of Engineering

4. *Text book title, author, and year:*
   - None, although any standard thermodynamics, fluids/heat transfer text is used as reference.

   a. *Other supplemental materials:*
      None.

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Study of systems involving fluid and thermal phenomena such as energy conversion, and fluid and thermal energy support. Using fundamentals studied in prerequisite courses, component and system analyses, for purpose of design optimization, are emphasized using integral, differential and lumped-parameter modeling techniques. The course focuses on the design process using design-oriented laboratory projects. Generally offered fall.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 331 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program Required*
      Mostly an elective for the Mechanical Engineering program. Either ME 482 or ME 456 is required however.

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

- Identify and describe the primary physical mechanisms associated with a variety of fluid and thermal systems, devices or processes (a,c,e,k)
- Apply appropriate fundamental principles to formulate theoretical models governing the performance of fluid and thermal systems, devices and processes (a,e)
- Utilize theoretical models as a means for evaluating the influence of various design parameters (a,b,c)

- Develop and utilize experimental techniques as a tool for gaining physical insight for model development, and as a means for model validation (b,c)
- Design , develop, construct and experimentally evaluate the performance of a functional fluid and thermal system, component or process (b,c)
- Write quality design proposals and technical reports (g)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, e, g, k

7. *Brief list of topics to be covered:*
   - Review of thermodynamics, fluid mechanics and heat transfer
   - Modeling temperature measurement errors; transient lag error, steady-state conduction error
   - Modeling variable-area flowmeters; design constraints and need for calibration experiments
   - Designing a method for leak detection in vacuum-actuated control systems; value of modeling and guidance to designing appropriate testing procedure
   - Heat exchanger theory
   - Modeling climate control systems for optimal energy savings

1. *Course number and name:*
   ME 484: Vehicle Dynamics

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Johann Pankau, Visiting Instructor

4. *Text book title, author, and year:*
   - Class notes
   - Script: Vehicle Dynamics, by Johann Pankau

   a. *Other supplemental materials:*
      - Fundamentals of Vehicle Dynamics; T Gillespie 1992, The Automotive Chassis; J Reimpell 2001, Chassis Handbook; B. Heissing 2011 , Tires, Suspension and Handling; J. Dixon 1991

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Vehicle dynamics analyses including: governing equation of motion, road loads, gradeability, aerodynamic forces and moments, longitudinal acceleration and braking performance prediction, lateral handling characteristics, vertical comfortability criteria, vehicle ride evaluation, and operating fuel economy analysis. Generally offered winter.
   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 322 and major standing.
   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective course

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:
   - Interpret relevant vehicle dynamics parameters as: vehicle axle coordinates, inertias, loads, mass distribution. (a, e, g, h, j, k)
   - Calculate vehicle loads, forces and reactions coming from interaction of the vehicle with the environment during driving. (a, e, h, k)
   - Explain how vehicle systems are interacting with the road and air during different driving conditions. (a, e, g, k)
   - Understand the key aspects of longitudinal, vertical and lateral vehicle dynamics, as: vehicle resistances, slip angle, ride comfort, handling parameters. (a, e, g, k)
   - Be able to set up simple spring, damper, mass models to estimate vehicle dynamics behaviors. (a, e, g, k)

- Explain how in real world the Lateral, Longitudinal and Vertical Vehicle Forces are interacting with vehicle systems and which vehicle behaviors are they causing. (a, e, f, g, h, j, k)
- List and describe chassis components important to the vehicle dynamics. (a, e, g, k)
- Understand how tire as major system in the vehicle is interacting with the road during rolling, accelerating, braking and cornering. (a, e, g, k)
- Explain the fundamental of brake force distribution between front and rear axle. (a, e, g, k)
- Describe vehicle resistances and base on this estimate vehicle engine output requirements. (a, e, g, k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
Course addresses ABET Student Outcome(s): a, e, f, g, h, j, k

7. *Brief list of topics to be covered:*
   - Introduction: applied mechanics and mathematics utilized in vehicle modeling vehicle axis systems, centre of gravity, loads, inertias
   - Longitudinal Vehicle Dynamics,
     - Dynamic axle loads at acceleration or deceleration
     - Traction limited acceleration, climbing, traction control
     - Traction limited braking, brake stability
     - Brake forces distribution
     - Vehicle resistances and engine output requirements
   - Vertical Vehicle Dynamics
     - Vibration, noise classification, propagation and phenomenon's
     - Simple vertical dynamics modeling
     - Road excitation
     - Suspension springing and shock absorbing
   - Lateral Vehicle Dynamics
     - Lateral acceleration, forces and slip angle
     - Low speed cornering
     - Vehicle under-steering, over-steering and self steering
     - Vehicle stationary and non-stationary cornering, line change
     - Lateral dynamics modeling
   - Interaction between longitudinal, vertical and lateral dynamic
     - 3-Dimensional interaction
     - Vehicle pitch and roll motions and General considerations
     - Vertical Force Variations
     - Braking, accelerating while cornering, braking on split μ surface
     - Vehicle Dynamics Target Conflicts
   - Introduction to chassis systems
     - Suspension design, classification, kinematics and elastokinematics
     - Introduction to brake systems and importance in vehicle dynamics control
     - Introduction to tire as major system in vehicle dynamics

1. *Course number and name:*
   ME 486 – Mechanical Systems Design

2. *Credits and contact hours:*
   4 credits; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Michael A. Latcha, Associate Professor of Engineering

4. *Text book title, author, and year:*
   Shigley's Mechanical Engineering Design, 9th Edition
   R.G. Budynas, J.K. Nisbett, McGraw-Hill, 2011.

   a. *Other supplemental materials:*
      None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Study of systems involving mechanical elements. Includes safety, stress, strength, deflection economic and social considerations, optimization criteria and strategies. Analysis and design of fasteners, springs, welds, bearings, power transmitting elements and complex structures subjected to static and/or dynamic loads. With project. Generally offered winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 361 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - Demonstrate proficiency in the fundamentals of stress analysis: uniformly distributed stresses, elastic strain, shear and bending-moments in prismatic beams, normal and shear stresses in bending, torsion, stresses in pressure vessels (a,e,k)
   - Define and apply in design problems the concepts of deflection and stiffness, general spring rates, deflection due to bending, strain energy, Castigliano's method, Euler and Johnson columns (a,e,k)
   - Design components and systems for static strength, including the use of factors of safety, failure theories and stress concentrations (a,c,e,k)
   - Design components and systems against fatigue, including the use of the endurance limit, modifying factors, fluctuating stresses, torsion, combined loading, cumulative fatigue damage (a,c,e,k)

- Explain the design considerations in the use of screws, fasteners, and connections and apply them in design problems (a,c,e,k)
- Explain the design considerations of welded, brazed and bonded joints and apply them to design problems (a,c,e,k)
- Explain the design considerations of mechanical springs and apply them to design problems (a,c,e,k)
- Explain the design considerations of spur gears and apply them to design problems (a,c,e,k)
- Explain and apply the rudiments of structural optimization (a,c,e,k)
- Schedule, conduct and present, both written and orally, minor and major design projects (b,d,e,f,g,h,i,j)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, d, e, f, g, h, i, j, k

7. *Brief list of topics to be covered:*

Static Body Stresses: review of free-body diagrams, forces acting on machine components, principal stresses given a biaxial state of stress, shear force and bending moment diagrams, maximum normal and shear stresses in prismatic beams, stresses and deflections in members subject to pure tension, compression or torsion, stresses in thin-walled pressure vessels and the basic concepts of material science.

Elastic Strain, Deflection and Stability: define general spring rates; calculate deflections due to bending by direct integration, superposition and using singularity functions; compute the total strain energy in a system under load; apply Castigliano's Method to find the deflections of mechanical systems and analyze and design Euler and Johnson columns.

Failure Theories, Safety Factors, Reliability and Fatigue: define and apply factors of safety; define and use four main failure theories to design machine components; calculate stress concentrations for ductile materials; be able to design for alternating and fluctuating stresses under combined loadings; be able to define and use endurance limits; be able to modify and apply endurance limits for specific applications.

Design of Mechanical Elements: design and use standard machine components, including but not limited to, screws, fasteners and other connections; welded and bonded joints; mechanical springs and gear systems.

1. *Course number and name:*
   ME 487 – Mechanical Computer-Aided Engineering

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Randy Gu, Professor of Engineering

4. *Text book title, author, and year:*
   - None

   a. *Other supplemental materials:*
      - Class notes posted online

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Introduction to the use of state-of-the-art finite element technology in mechanical engineering analysis. Fundamentals of computer graphics, solid modeling, finite element modeling and interactive design. Analysis and evaluation of linear static and dynamic mechanical systems. With project. Generally offered fall.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 308 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective for mechanical engineering major

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   To acquaint students with the state-of-the-art finite element (F.E.) technology in solving mechanical engineering design problems such as stress analysis, dynamic structural response, heat conduction, etc. By the end of the course, the successful student will be able to:

   - Determine the principal and von Mises stresses of 3D stress states, and the corresponding factor of safety (a, e, k);
   - Identify types of plane elasticity models (a, e, i, k);
   - Form total finite element systems, impose boundary conditions, and calculate the displacements of active nodal degrees for plane frames (a, e, k);
   - Create 2D solid models from given 3D IGES files (a, b, e, g, k);

   a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
      Course addresses ABET Student Outcome(s): a, b, e, g, i, k

7. *Brief list of topics to be covered:*
   - Introduction to Elasticity and Structural Mechanics
     Stresses and Strains, Constitutive Laws, Plane Elasticity, Principal and Effective Stresses, Stress Intensity, Failure Theories, Trusses, Beams, Plates, Shells
   - Introduction to Finite Element Method (FEM, FEA)
     Formulation, Characteristics of Various Elements, Example by Hand Calculation
   - Solid Modeling
     Computer Environment (PC's, Network, Printers), ANSYS Program and Input Files, Geometric Entities, Primitives, Boolean Operations, Transferring/Importing IGES Files
   - Finite Element Analysis Using ANSYS (Classic / Workbench)
     Trusses, Frames, Plane Problems, Thermal Stresses, Contact Problems, Post-Processing in ANSYS (Classic / Workbench)
   - Structural Dynamics
     Introduction to Vibration, Natural Frequencies, Mode Shapes, Harmonic Response Analysis, Transient Dynamic Analysis
   - Thermal Analysis (time permitted)
     Introduction to Heat Conduction, Steady-State Thermal Analysis, Thermal Mechanical Analysis

1. *Course number and name:*
   ME 488 - Mechanical Computer-Aided Manufacturing

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Randy Gu, Professor of Engineering

4. *Text book title, author, and year:*
   - None

   a. *Other supplemental materials:*
      - *Computer-Aided Manufacturing*, 3rd edn., TC Chang, RA Wysk, HP Wang, Prentice Hall, 2005, ISBN 0-13-142919-1.
      - *CAD/CAM Principles, Practices and Manufacturing Management*, C. McMahon and J. Browne, 2nd Edn., Addison-Wesley; 1998.
      - *Computer-Integrated Design and Manufacturing*, D. Redworth, M. Henderson, and P. Wolfe, McGraw-Hill, 1991.

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Use of CATIA in various aspects of manufacturing processes. GD&T and tolerance analysis; surface design, managing cloud points and reverse engineering; simulation of kinematics of machine tools; 3-axis surface machining; mold tooling design; CMM and measurement data analysis; assembly simulation and structural analysis, rapid-prototyping. Includes design projects in various topics. With project. Generally offered winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 308 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective for mechanical engineering major

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   To acquaint students with the state-of-the-art computer technology in solving mechanical manufacturing problems such as surface design, NC machining, mold core and cavity design, weld design, structure build evaluation, etc. By the end of the course, the successful student will be able to:

   - Create parts with sculpted surface (a, b, c, e, g);
   - Determine dimensional quality of structure builds (a, b, c, e, g, j, k);
   - Analyze postures under manufacturing environment using digital human (c, f, h, j, k);

- Simulate 3D NC machining (a, b, e, g, k);
- Manage point cloud and reconstruct digitized 3D surfaces (a, b, e, k);
- Design core and cavity for molded parts and tooling (a, b, c, e, g, k);
- Model welds in assemblies (a, b, e, g, k).

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, e, f, g, h, j, k

7. *Brief list of topics to be covered:*
   - CATIA Fundamentals - Review
     Sketch-based features; dimensional and geometric constraints; pad and pocket; holes; shaft; sheet metal design; and assembly design
   - Weld Design
     Creating various welds; physical properties of welds; editing and extending welds; creating joints and joint bodies; annotating welds
   - Stress and Modal Analysis
     Finite element theory; failure theories; apply material properties; mesh control; specify boundary constraints; create applied loads; post-processing; stress analysis of assemblies; free vibration of assemblies; modal analysis examples
   - Curves and Surface Design
     Parametric representation of curves; Bezier curves; 2D and 3D splines; surface modeling; surfaces by revolving, extruding, loft, and sweeping; curves by intersection and projection; creating free style surfaces and styling fillets; deforming surfaces; analyzing curves and surfaces
   - BEv - Dimensional Quality Evaluation of Assemblies
     Coordinate measuring machines; best-fit algorithms, CMM data processing; BEv; determination of dimensional quality of structure builds
   - Mold Tooling and Core-Cavity Design
     Terminology, creating mold base, gates, runners, and coolant channels; inserting leader pins; positioning ejector pins; defining main pulling and slider directions; creating parting surfaces; aggregating surfaces;
   - Generative Machining
     Theory of NC; prismatic machining, 3D surface machining, multi-axis milling; lathe machining
   - Rapid Prototyping
     Processing of raw data, scaling and rotating model, adding label and text to model, changing surface color, 3D printing of models.
   - Ergonomic Design and Analysis
     Kinematic chain, forward and inverse kinematics, human builder; human activity analysis; human measurement editor; human posture analysis
   - Digitized Surfaces (time permitting)
     Point cloud management; tessellating cloud points; creating sections from cloud points; reverse engineering

1. *Course number and name:*
   ME489: Fasteners and Bolted Joints

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's name:*
   Sayed A. Nassar, Distinguished Professor

4. *Text book title, author, and year:*
   - Handbook of Bolts and Bolted Joints" John Bickford and Sayed Nassar, Editors, Marcel Dekker, N.Y.,

   a. *Other supplemental materials:*
      - Workbook (500-page: compiled by course Instructor-Sayed A. Nassar)

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Systems approach to the analysis and reliability of bolted joints under static and dynamic loads. Variables include the fastener, the joint, tool, control method, post assembly loads, relaxation and environmental factors. Laboratory experiments include torque tension, role of friction, ultrasonics, non-parallel contact and elastic interactions. Generally offered winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 486 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program:*
      Elective course in mechanical engineering

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of this course, students will be able to follow a systems approach and utilize their basic engineering knowledge to:
   - Demonstrate proficiency in identifying variables relevant to the reliability of bolted joint systems (f).
   - Assess the suitability of various process control method for bolted joint assembly (a,b,g).
   - Demonstrate proficiency in identifying variables that contribute to clamp load decay in bolted assemblies (a,b,e).

- Perform static and fatigue analysis of preloaded joints under external service loads (a,c,e).

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, e, f, g

7. *Brief list of topics to be covered:*
   1- Introduction to Fasteners and Bolted Joints: a systems approach.
   2- Torque-Tension correlation
   3- Role of friction: underhead friction, thread friction
   4- Automation and process control of the assembly process: control methods
   5- Reliability of bolted joints
   6- Use of Non-Destructive Testing in bolted joints: ultrasonics, optics
   7- Linear and non-linear behavior of bolted joints: Joint diagram
   8- Fatigue analysis of bolted joints
   9- Hydrogen Embrittlement of fasteners
   10- Corrosion mechanism, and corrosion protection
   11- Stress Corrosion Cracking SCC
   12- Vibration loosening mechanism
   13- Three Lab Experiments : Torque-Turn-Tension, Elastic Interaction, Vibration Loosening

1. *Course number and name:*
   ME 492 – Senior Mechanical Engineering Design Project

2. *Credits and contact hours:*
   4 credits; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Michael A. Latcha, Associate Professor of Engineering

4. *Text book title, author, and year:*
   None

   a. *Other supplemental materials:*
      None

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      Multi-disciplinary team experience in engineering design, emphasizing realistic constraints such as safety, economic factors, reliability, aesthetics, ethics and societal impact. Projects will be supervised by engineering faculty. Generally offered fall, winter. Satisfies the university general education requirement for the capstone experience. Satisfies the university general education requirement for a writing intensive course in the major. Prerequisite for writing intensive: completion of the university writing foundation requirement. Generally offered fall and winter.

   b. *Prerequisites or co-requisites:*
      Prerequisites: ME 308, ME 331, ME 361, ME 372 and major standing.

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Required

6. *Specific goals for the course: Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
   By the end of the course, the successful student will be able to:

   - Demonstrate an ability to apply knowledge of mathematics, science, and engineering (a)
   - Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data (b)
   - Demonstrate 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)
   - Demonstrate an ability to function on multi-disciplinary teams (d)
   - Demonstrate an ability to identify, formulate, and solve engineering problems (e)
   - Demonstrate an understanding of professional and ethical responsibility (f)

- Demonstrate an ability to communicate effectively (g)
- Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (h)
- Demonstrate a recognition of the need for, and an ability to engage in life-long learning (i)
- Demonstrate a knowledge of contemporary issues (j)
- Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
   Course addresses ABET Student Outcome(s): a, b, c, d, e, f, g, h, i, j, k

7. *Brief list of topics to be covered:*

The purpose of these classes is to introduce the undergraduate student to the principles of successful engineering design and to guide students through practical design experiences. While there will be few (if any) formal lectures, the following topics will be demonstrated through practical example:

- Design process: Objectives and criteria, synthesis, analysis, construction, testing and evaluation.
- Design constraints: Safety, economic factors, reliability, aesthetics, ethics and societal impact.

Course Number:	**ECE 431**
Course Name:	Automatic Control Systems
Credits:	4
Contact Hours:	Lecture – 2 Meetings at 107 minutes per meeting per week.
Instructor Name:	Robert Loh
Text Books:	1. Ogata, K., Modern Control Engineering. Englewood Cliffs, NJ: Prentice Hall, 2009, 5th Ed. 2. Robert N. K. Loh., Complete Set of Lecture Notes.
Course Description:	Mathematical modeling of dynamic systems, transfer functions and block diagrams. State-space representations and local linearization of nonlinear systems. Transient and steady-state analysis, stability criteria and state-feedback control. The root-locus method and frequency-response method for control systems analysis and design. Design of PID controllers and compensation networks. Controllability and observability for linear time invariant system2. Computer simulations using Matlab. With laboratory.
Prerequisite:	ECE 335
Type:	Professional Elective

Course Objectives:

1. Be able to APPLY Laplace and inverse Laplace transform techniques and methodology to problem solving, such as combing the partial fraction expansion (residue) method with Matlab to obtain the responses of complex feedback control systems. (Laplace transform is one of the most useful and powerful tools for solving engineering problems and will remain so throughout our engineering career) (a, b, e, i, k)
2. Be able to model and/or write equations of motion for electrical and mechanical components and systems – these are some of the basic backbone elements of control engineering (a, b, e, i, k)
3. Be able to analyze and interpret data of linear systems, such as the rise time, peak time, settling time, damping ratio, and maximum overshoot subject to step inputs (a, b, e, i, k)
4. Be able to develop state-space representation for systems; obtain state-space realizations from transfer functions for linear systems; and carry out simulation studies with Matlab (a, b, e, i, k)
5. Be able to analyze and design control systems to meet desired performance criteria, such as system stability, damping ratio, maximum overshoot, peak time, settling time and steady-state error using root-locus, Routh-Hurwitz stability criterion, Bode plot, and Matlab (a, b, e, i, k)
6. Be able to benefit from using Matlab in problem solving. Matlab enhances my learning process (Matlab has become a default design and simulation tool in modern science and engineering) (a, b, e, i, k)
7. Be able to communicate and practice teamwork skills with my teammates in completing homework assignments, laboratories, and projects (g)
8. Be able to apply knowledge of mathematics, science and engineering for modeling, analyzing and designing feedback control systems (a, b, e, i, k)

Course Outcomes:

a	b	c	d	e	f	g	h	i	j	k
x	x			x		x		x		x

Course Topics:
1. Introduction to Control Systems and Applications
2. Mathematical Modeling of Mechanical and Electrical Systems
3. Analysis of Transient and Steady-State Responses
4. Control Systems Analysis and Design by the Root-Locus Method
5. Control Systems Analysis and Design by the Frequency-Response Method
6. Design and Computer Simulation of PID Controllers with Applications
7. Modeling, Analysis and Design of Control Systems in State-Space

Approved by: Robert Loh
Date: 6/06/2014

Course Number:	**ECE 475**
Course Name:	Automotive Mechanotronics I
Credits:	4
Contact Hours:	Lecture – 2 Meetings at 107 minutes per meeting per week. Laboratory – 1 Meeting at 3 hours per meeting per every two weeks.
Instructor Name:	Ka C. Cheok
Text Book:	Introduction to Mechatronic Design, the new first edition from authors Carryer, Ohline, and Kenny.
References:	1. Intro to Mechatronics & Measurement Systems, D.G. Alciatore & M.B. Histand; McGraw-Hill, 1999. 2. Bosch GmbH, Mechatronics – Theory & Application, SAE 3. Ronald Jurgen, Automotive Electronics Handbooks, McGraw-Hill, Inc.
Course Description:	Overview of mechatronics, modeling, simulation, characterization and model validation of electromechanical devices; introduction to computer-aided software; basic automotive sensors; basic actuators and power train devices; principles of automotive and industrial electronic circuits and control systems (analog and digital); principles of produce design; mechatronics case studies. With laboratory.
Prerequisites:	ECE 276, 335 and major standing
Type:	Professional Elective

Course Objectives:
1. Illustrates concepts, principles, design analysis and synthesis of automotive mechatronics systems (computer control, electronics and mechanical systems in an automobile, robotics and automation), and its impact on modern society (h, i, j)
2. Review engineering principles for an automotive/robotics/mechatronics concept (a, e)
3. Focus on selected topics through simulation assignments to demonstrate theoretical aspects of mechatronics using Matlab/Simulink/Simscape, Saber) (b, c, k)
4. Focus on selected topics through lab experiments to demonstrate practical aspects of mechatronics with embedded controllers (dsPICs, Arduinos) (b, c, k)
5. Trade-offs in design, requirements, cost, software, hardware, technology (f, h, i, j)
6. Term projects for groups of three students; projects must reflect as many aspects of the course topics (c, d, e, g, h, i, j, k)

Course Outcomes:

a	b	c	d	e	f	g	h	i	j	k
x	x	x	x	x	x	x	x	x	x	x

Course Topics:
1. Illustration of mechatronics in automotive, robots and automation (the present & future)
2. Multidisciplinary mechatronic systems, systems of systems (views from low and high level)
3. Math model for digital, electrical, electronics, mechanical, thermodynamic systems (math)
4. Computer simulation and analysis techniques using Matlab and Saber software (insights)
5. Overview of control theory and examples of its applications (behavior science)

6. Overview of analog controllers, digital logic controllers and micro-controllers (decision makers)
7. Overview of signal conditioning, small signal, large signal, power electronics (function & chips)
8. Sensors and actuators, with experiments (senses & muscles)
9. System characterization, model validation (test and understanding)
10. Performance prediction and verification (thinking ahead and checking it)
11. Data acquisition and computer interface (get and give data)
12. Microcontrollers and programming (manipulating data and making decision, PC, dsPIC)
13. Design analysis techniques (response, statistics, stress (weak points), sensitivity (changes), heat)
14. Design synthesis consideration (packaging, size, weight, form, EMC, cost, manufacturing, sources)
15. Automotive or automation mechatronics class projects (hands-on teamwork experience)
16. Future applications (automation in home, business, transportation, unmanned vehicle systems)

Approved by: Ka C. Cheok
Date: 6/16/2014

ISE 483/583, Production Systems and Work Flow Analysis
Credit Hours: 4 credits, 3.57 contact hours/week.

Instructor: Sankar Sengupta, Ph.D.
Text book: DESIGN AND ANALYSIS OF LEAN PROUCTION SYSTEMS, Ronald G. Askin and J.B. Goldberg, John Wiley Publication, 2002 (ISBN 0-471-11593-2)

Specific course information:

Course Description- Design issue to control the flow of material in manufacturing systems from forecast to finished product, topics include aggregate planning and disaggregation, inventory control, MRP, JIT systems, scheduling, project planning and resource balancing, application of lean principles, theory of constraints, supply chain and facilities planning and layout.

Prerequisites: ISE 330 and major standing.

Elective course

Course Objectives:

On successful completion of this course a student should be able to do the following (Refer to Student outcomes a – k attached at the end of the syllabus):

- characterize a production system based on multiple attributes (a, b),
- list the benefits of aggregate planning and disaggregation of a production plan (b, e),
- list the costs and benefits of holding inventory (b, e),
- categorize the SKUs and design an inventory control system (a, b, c),
- list the factors responsible for variance amplification in a supply
- Chain (a, e),
- apply the principles of lean manufacturing and factory physics to a production system (a, b, e),
- apply the Theory of Constraints to a production system (a, b, e),
- identify the critical path in a project and solve a line balancing
- Problem (a, b, c, d, g, k),
- understand the complexities of a real-time scheduling problem (a, b. k),
- list the issues associated with facility location problem (b, d, g, k),
- apply different methods to solve a plant/office layout problem (a, b, k).
- apply tools learnt in this course to health-care systems (e, j, k).

List of Topics:

Date	Topics
Topic 1 Week 1	Characterization of production systems, role of inventory and broad overview of the course.
Topic 2 Week 2-3	Development of aggregate production planning model, review of related concepts of linear programming, disaggregation of an aggregate plan.
Topic 3 Week 4-5	Introduction to inventory models including deterministic models as well as models with uncertain demand and lead time. Continuous review

	models, periodic review models, single-period models, cost based as well as service level based models.
Topic 4 Week 6	Network representation of a project and identification of the critical path, analysis with limited resources.
Topic 5 Week 7-8	Application of lean principles and the principles of factory physics in a production system, topics include identification of different forms of wastes, value stream map of a process.
Topic 6 Week 9-10	Discussion on complexities of real world scheduling problems, characterization of scheduling problems and application different heuristic rules, discussion on Theory of Constraints to a production system.
Topic 7 Week 11-12	Introduction to facility location and layout problems, discussion on facility location models.
Topic 8 Week 13-14	Discussion on Data Envelopment Analysis, discussion on real world examples, discussion on projects and review.

ISE 485/585, Statistical Quality Control.
Credit Hours: 4 credits, 3.57 contact hours/week.

Instructor: Sankar Sengupta, Ph.D.

Text book: Introduction to Statistical Quality Control, Douglas C. Montgomery, 6th Edition, John Wiley Publication, 2009 (ISBN 978-0-470-16992-6).

Specific course information:

Course Description- Fundamentals of statistical quality control, control charts for variable and attribute data, cusum charts, DNOM charts, estimation of process capability, statistical tolerancing and sampling plans. Fundamentals of design of experiments and application to product/process design, Taguchi's approach to robust design and related topics.

Prerequisites: ISE 318 and major standing.

Elective course

Course Objectives:

On successful completion of this course a student should be able to do the following (Refer to Student outcomes a – k attached at the end of the syllabus):

- Define quality for a manufacturing process as well as a service process
- (a, e),
- Set-up variable data and attribute data control charts and use them to
- monitor a process (k, b),
- Discuss the differences between a capable process and a process operating
- in control (e),
- Estimate different measures of process capability and use them to certify a
- process (a, b, d, g, e).
- Apply the principles of statistical tolerance to estimate the impact of
- tolerance stack-up (a, e),
- Describe the role of "designed experiments" in improving quality (c, d, g,
- e),
- Use designed experiments to estimate the components of variance (c, k),
- Differentiate between the classical and the "Taguchi's" approach to design of experiments and analysis of results (k, b).
- Application of statistical control tools in health care industry (a, e, k, j).

List of Topics:

Date Topics

Topic 1 Week 1	Review of statistics, basic probability distributions, parameter estimation and test of hypotheses.
Topic 2 Week 2-3	Variable data and attribute data control charts, cusum chart, DNOM chart
Topic 3 Week 4	Estimation of process capability, capability indices such as C_p and C_{pk}, sources of variation in a process, need to operate a process in control
Topic 4 Week 5-6	Introduction to design of experiments, single factor randomized design, randomize block design, full factorial and fractional factorial design, components of variance model.
Topic 5 Week 7	Taguchi's approach to robust design, use of control charts in healthcare, and review for the final test. (**Seven week semester with double contact hours/week)**

Course Number and Name: MTH 154, Calculus I
Credit and Contact Hours: 4 credits, 3.57 contact hours/week
Instructor: Aycil Cesmelioglu, Ph.D.
Textbook: Calculus: Early Transcendentals, 7th edition, by James Stewart, Brooks/Cole Centage Learning
Specific Course Information:

a. A detailed study of limits, continuity, derivatives of algebraic and transcendental functions, applications of derivatives, numerical techniques, integrals and the Fundamental Theorem of Calculus. ***Satisfies the university general education requirement in the formal reasoning knowledge foundation area.***
b. Prerequisite(s): MTH 141 with a grade of 2.0 or higher or placement.
c. Required class.

Specific Goals for the Course:
The concept of a real-valued or vector-valued function of real variables is one of the most important mathematical tools used to describe, evaluate, and predict real world phenomena. MTH 154 is the first course in a sequence of courses designed to expand the student's understanding of the relationship between real world phenomena and function descriptions of the phenomena. Building on the student's pre-calculus knowledge, this course introduces the limit concept and several of its major theoretical applications; continuity, the derivative, and the integral. The successful student will develop an intuitive understanding of the derivative as the slope of the tangent line of a function and as the instantaneous rate of change of a function; the ability to apply the dual interpretations of the derivative to describe functional behavior and to solve optimization problems; an intuitive understanding of the integral as the proper generalization of the rate times time formula of high school science, as an area under a curve, and as an antiderivative; the ability to perform elementary applications involving the dual nature of the integral; a beginning understanding of the relationship between the derivatives and the integral (the Fundamental Theorem of the Calculus); and computational facility with some elementary limit computations, computation of derivatives of elementary functions and functions composed of the elementary functions, and some elementary computational facility with integrals.
Topics:
Introduction
Chapter 2: Slopes & Rates of Change, Intuitive Limits, Limit Thms., Precise Definition of a Limit, Continuity, Intermediate Value Thm., Limits at Infinity, Derivatives & Rates of Change, Derivative as a Function.
Chapter 3: Derivative Formulas (Linearity, Power, And Exponential Fns.), Product & Quotient Rules, Trigonometric Fns., Chain Rule, Implicit Differentiation, Inverse Trig. Fns., Logarithmic Fns. & Logarithmic Differentiation, Related Rates Problems, Linear Approximation & Differentials.
Chapter 4: Local and Absolute Extrema, Critical Points, Mean Value Thm., Graphical Relations (Monotonicity, Loc. Ext., 1st Der. Test), More Graphical Rel. (Concavity, 2nd Der. Test, Inflections Pts.), Indeterminate Forms, L'Hospital's Rule, Applied Optimization, Antiderivaties
Chapter 5: Area & Distance, Definition of the Integral, Fundamental Theorem of Calculus, Indefinite Integrals, Net Change, Substitution

Course Number and Name: MTH 155, Calculus II
Credit and Contact Hours: 4 credits, 3.57 contact hours/week
Instructor: Anna Spagnuolo, Ph.D.
Textbook: Calculus, Single Variable, Early Transcendentals, 7th edition, by James Stewart, published by ITP
Specific Course Information:

a. A detailed study of methods of integration, applications of the integrals, improper integrals, sequences, series and power series, polar coordinates, and parametric curves. ***Satisfies the university general education requirement for the knowledge applications integration area. Prerequisites for knowledge applications: completion of the university general education requirement in the formal reasoning knowledge foundation area.***
b. Prerequisite(s): MTH 154 with a grade of 2.0 or higher.
c. Required class.

Specific Goals for the Course:
To introduce students to the concepts in Chapter 6: Applications of Integration; Chapter 7: Techniques of Integration; Chapter 8: Further Applications of Integration; Chapter 10: Parametric Equations and Polar Coordinates; Chapter 11: Sequences and Series; Chapter 9: Differential Equations
Topics:
Chapter 6: Applications of Integration (4.5 hours)
Chapter 7: Techniques of Integration (9-10 hours)
Chapter 8: Further Applications of Integration (3.5-4 hours)
Chapter 10: Parametric Equations and Polar Coordinates (4.5 hours)
Chapter 11: Sequences and Series (13.5 hours)
Chapter 9: Differential Equations (1.5 hours)

Course Number and Name: MTH 254, Multivariable Calculus
Credit and Contact Hours: 4 credits, 3.57 contact hours/week
Instructor: Louis Jack Nachman,, Ph.D.
Textbook: Calculus: Early Transcedentals, 7^{th} edition, by James Stewart, published by Brooks/Cole
Specific Course Information:

a. A study of vectors, polar coordinates, three-dimensional geometry, differential calculus of functions of several variables, exact differential equations, multiple integrals, line and surface integrals, and vector fields.
b. Prerequisite(s): MTH 155 with a grade of 2.0 or higher.
c. Required class

Specific Goals for the Course:
To introduce basic concepts in multivariable calculus.
Topics:
3D coordinates, Vectors, Dot Product, Cross Product, Equations of lines and planes, Cylinders and Quadratic Surfaces, Vector Functions and Space Curves, Derivatives and Integrals of Vector Functions, Arc Length and Curvature, Motion in Space, Functions of Several Variables, Limits and Continuity, Partial Derivatives, Tangent Planes and Linear Approximation, The Chain Rule, Directional Derivatives and the Gradient Vector, Optimization Problems, Lagrange Multipliers, Double Integrals over rectangles, Iterated Integrals, Double Integrals over General Regions, Double Integrals in Polar Coordinates, Applications of Double Integrals, Triple Integrals, Triple Integrals in Cylindrical and Spherical Coordinates, Change of Variables in Multiple Integrals, Vector Fields, Line Integrals, Fundamental Theorem of Line Integrals, Greens' Theorem, Divergence and Curl, Parametric Surfaces and Area, Surface Integrals, Stokes Theorem, The Divergence Theorem

Course Number and Name: PHY 161, Fundamentals of Physics I
Credit and Contact Hours: 4 credits, 3.57 contact hours/week (lecture) and 2 contact hours per week (supplemental instruction)
Instructor: Brad Roth, Ph.D.
Textbook:

a. Principles of Physics, 5^{th} edition, by Serway / Jewett, Cengage Publishing
b. **Other Supplemental materials:**
    a. Enhanced WebAssign Access Card
    b. Enhanced WebAssign Start Smart Guide

Specific Course Information:

a. Classical mechanics and thermodynamics. For science, mathematics and engineering students. This course has common lectures with PHY 151. PHY 161 does not satisfy the university general education requirement in the natural science and technology knowledge exploration area.
b. Prerequisite(s): MTH 154 recommended.
c. Required class.

Specific Goals for the Course:

- Learning basic concept and principles of mechanics and thermodynamics
- Analyzing physical problems using mathematics
- Applying physics to our daily world

Upon completion of this course, students will be able to:

- o Use general methods of problem solving to sharpen critical thinking skills
- o Convert between units and use these as an aid in problem solving
- o Add and subtract vectors graphically and resolve them into components
- o Describe the motion of an object moving in one dimension
- o Analyze the motion of an object along a trajectory in two dimensions
- o Construct free-body diagrams
- o Understand Newton's laws of motion
- o Predict the motion of a satellite in a circular orbit
- o Explain the conservation of energy and conservation of momentum
- o Understand the concepts of torque and moment of inertia
- o Describe the oscillation of a mass-spring system and pendulum
- o Compare concepts of pressure and density in solids, liquids, and gases
- o Convert temperature readings from one scale to another
- o Apply the concepts of specific heat and latent heat
- o Analyze the behavior of gases using the ideal gas law
- o State and understand the first law of thermodynamics
- o Appreciate the importance of the second law of thermodynamics
- o Calculate the efficiency of different heat engines.

Topics:
Classical Mechanics: motion in one and two dimensions, Newton's law of motion, energy, momentum, rotational motion, gravity, oscillations, waves, fluid mechanics.

Thermodynamics: Temperature, kinetic theory of gases, thermal energy and heat, the first law of thermodynamics, the second law of thermodynamics.

Course Number and Name: PHY 162, Fundamentals of Physics II
Credit and Contact Hours: 4 credits, 3.57 contact hours/week (lecture) and 2 contact hours per week (supplemental instruction)
Instructor: Evgeniy Khain, Ph.D.
Textbook:

a. Principles of Physics, 5th edition, by Seway / Jewett, Cengage
b. **Other Supplemental Materials:**
    a. Enhanced WebAssign Access Card
    b. Enhanced WebAssign Start Smart Guide

Specific Course Information:

a. Sound, light, electricity and magnetism. This course has common lectures with PHY 152. ***Satisfies the university general education requirement in the knowledge applications integration area. Prerequisite for knowledge applications integration: completion of the general education requirement in the natural science and technology knowledge exploration area.***
b. Prerequisite(s): PHY 151 or 161 recommended.
   Corequisite(s): MTH 155 recommended.
c. Required class.

Specific Goals for the Course:
Goals of this course include: applying notions and models learned in the previous Introductory Physics I course to the understanding of new, advanced concepts and principles of physics; applying notions learned in the previous Calculus I course for problem solving; learning to utilize advanced Calculus methods to produce a mathematical representation of and to analyze physical situations; introduce a wide range of applications to fields other than physics; incorporate contemporary physics in the course and utilize this to analyze the ethical and societal implications of its applications.
Topics:
Electricity & Magnetism: *Electric field*: Coulomb's Law, Electric Flux, Gauss's Law, Electric Potential, Conductors and Dielectrics, Capacitance; *Electric Current:* Resistance, Ohm's Law, Superconductors, Electric Energy and Power; *Direct Current Circuits:* Kirchhoff's Rules, RC Circuits. *Magnetic Field:* Force on a Current-Carrying Conductor, Torque on a Current Loop, the Bio-Savart Law, Force between two Parallel Conductors, Ampère's Law, the Magnetic Field of a Solenoid, Magnetism in Matter. *Inductance:* Faraday's Law, Lenz's Law, Self-Inductance, RL Circuits, Energy Stored in a Magnetic Field. *Electromagnetic Waves:* Maxwell's Equations, The Spectrum of Electromagnetic Waves, Polarization.
Optics: The Nature of Light, Ray Model in Geometric Optics, Reflection and Refraction Light, Image Formation by Mirrors and Lenses, Lens Aberration. *Wave Optics:* Interference and the Double-Slit Experiment, Diffraction, the Diffraction Grating, X-Rays Diffraction by Crystals.
Modern Physics: *Quantum Physics:* Blackbody Radiation and Planck's Theory, and Photoelectric and Compton Effects, the Particle Model of Light, the Wave Properties of Matter, the Quantum Particle, the Uncertainty Principle, the Schrödinger Equation, the Tunneling Effect. *Atomic Physics:* Early Models of the Atom, the Hydrogen Atom, Quantum Numbers and their Interpretation, the Exclusion Principle and the Periodic Table, Atomic Spectra. *Nuclear Physics:* Properties of Nuclei, Binding Energy, Radioactivity and the Radioactive Decay Processes,

Nuclear Reactions. *Particle Physics:* The Fundamental Forces in Nature, Elementary Particles, Antiparticles, Conservation Laws and Classification of Particles, Quarks and the Standard Model.

Course Number and Name: APM 255, Introduction to Differential Equations and Matrix Theory
Credit and Contact Hours: 4 credits, 3.57 contact hours/week
Instructor: Li Li, Ph.D.
Textbook: Differential Equations and Linear Algebra, 3rd edition, by Edwards & Penney, Pearson Prentice-Hall (no date given)
Specific Course Information:

a. Introduction to ordinary differential equations, Laplace transforms, linear systems, matrices, vectors, independence, Eigenvalues and eigenvectors, and applications. Replaces APM 257 and students cannot receive credit for both APM 255 and APM 257.
b. Prerequisite(s): MTH 155 with a grade of 2.0 or higher.
c. Required class.

Specific Goals for the Course:
The student should learn methods of solving certain differential equations, become familiar with mathematical models that lead to these types of differential equations, and master the necessary linear algebra to apply these methods and analyze solutions.
Topics:
Chapter 1: First Order Differential Equations, sections 1.1, 1.2, 1.4, 1.5. (6 hours)
Chapter 2: Mathematical Models, sections 2.1 – 2.3. (4 hours)
Chapter 3: Linear Systems and Matrices, sections 3.1 – 3.6. (8 hours)
Chapter 4: Vector Spaces, sections 4.1 – 4.4. (5 hours)
Chapter 5: Higher Order Linear Differential Equations, sections 5.1 – 5.6. (8 hours)
Chapter 10: Laplace Transforms, sections 10.1 – 10.4. (8 hours)

Course Number and Name: CHM 143, Chemical Principles
Credit and Contact Hours: 4 credits, 3.57 contact hours/week (lecture) and 1 contact hour per week (recitation)
Instructor: Jennifer Tillinger, Ph.D.
Textbook:

a. Chemistry, A Molecular Approach, 3rd edition, by Nivaldo Tro, Pearson, 2014.
b. Mastering Chemistry access code (packaged with text or e-book)
c. **Other Supplemental Materials:** Solution Manuel for Chemistry: A Molecular Approach, 3rd edition, by Tro, Shaginaw & Kramer

Specific Course Information:

a. States of matter, atomic structure, bonding and molecular structure, chemical reactions. This course has common lectures with CHM 157. CHM 143 does not satisfy the university general education requirement in the natural science and technology knowledge exploration area. Recommended preparation is three years of high school mathematics and one year of high school chemistry. Restricted to engineering and computer science majors.
b. Prerequisite(s): Score of 20 or higher on ACT mathematics exam; or MTH 062.
c. Required class.

Specific Goals for the Course:
This course satisfies the natural science and technology Knowledge Explorations Area of the general education curriculum. Students will be expected to demonstrate knowledge of major concepts from natural science, including the development and testing of hypotheses; drawing conclusions; the reporting of findings through the laboratory experience and how to evaluate sources of information in the chemical sciences. A capacity of critical thinking is required to successfully master and apply the material in this course.
Topics:
Intro
Chapter 1
Chapter 2
Chapter 3
Chapter 4
Chapter 5
Chapter 6
Chapter 7
Chapter 8
Chapter 9
Chapter 10
Chapter 11
Course Number and Name: BIO 111, Biology I
Credit and Contact Hours: 4 credits, 3.57 contact hours/week (lecture) and 1.67 contact hours per week (supplemental instruction)
Instructor: Ann Sturtevant, Ph.D.
Textbook:

a. Biology, 3rd edition, by Brooker et al., McGraw-Hill, 2013.

b. **Other Supplemental Materials:**
   a. Access to Connect or Connect Plus
   b. iClicker2 or iClicker

Specific Course Information:

a. Introduction to cellular and molecular biology, enzymology, metabolism, genetics, cell division. One year of high school chemistry is strongly recommended. ***Satisfies the university general education requirement in the natural science and technology knowledge exploration area.***

b. ***Science elective***

Specific Goals for the Course:

- describe the structure and function of macromolecules, organelles and membranes
- explain what enzymes are and how they work, and describe factors that affect enzyme activity
- outline the steps involved in respiration and photosynthesis and explain the function of each step
- describe how cells divide by mitosis and meiosis
- describe how the information encoded by DNA is used to make RNA and protein
- explain how genetic material is inherited during sexual reproduction, and how new traits may arise by changes in the DNA sequence
- predict the outcomes of monohybrid and dihybrid crosses (Mendelian genetics)

Topics:

Chap. 2: Chemical Basis of Life I: Atoms, Molecules, and Water
Chap. 3: Chemical Basis of Life II: Organic Molecules
Chap. 4: General Features of Cells
Chap. 5: Membrane Structure and Function
Chap. 6: Enzymes and Metabolism
Chap. 7: Respiration
Chap. 8: Photosynthesis
Chap. 11: Nucleic Acid Structure and DNA Replication
Chap. 12: Gene Expression at the Molecular Level: Transcription
Chap. 14: Mutation, DNA Repair
Chap. 13: Gene Regulation
Chap. 15: Eukaryotic Chromosomes. Mitosis and Meiosis
Chap. 16: Simple Patterns of Inheritance
Chap. 17: Complex Patterns of Inheritance
Chap. 18: Genetics of Viruses and Bacteria
Chap. 23: Evolution

1. *Course number and name:*
   PHL 104: Introduction to Ethics in Science and Engineering

2. *Credits and contact hours:*
   4 credit hours; 3.57 contact hours/week

3. *Instructor's or course coordinator's name:*
   Elysa Koppelman-White, Ph.D., Associate Professor

4. *Text book title, author, and year:*
   - Ethics in Engineering Practice and Research, 2nd edition. Caroline Whitbeck.

   a. *Other supplemental materials:*
      - Various materials online or on reserve.

5. *Specific course information:*
   a. *Brief description of the content of the course (catalog description):*
      A survey of canonical works in the history of Western ethical theory will give students a critical understanding of a plurality of viable ideas, principles, and criteria by which to evaluate and judge contemporary issues of ethical concern in the practice of science and engineering.

   b. *Prerequisites or co-requisites:*
      Prerequisite: None
      Co-requisite: None

   c. *Indicate whether a required, elective, or selected elective course in the program*
      Elective. This class satisfies the General Education requirements in Western Civilization.

6. *Specific goals for the course:*
   a. *Course Objectives (letters between parentheses show mapping to ABET student outcomes)*
      By the end of the course, the successful student will be able to:

   - Students will gain an understanding of professional and ethical responsibility. (f)
   - Students will gain an ability to understand the impact of engineering, computing, and scientific solutions in a global, economic, and societal context. (h)
   - Students will gain an understanding of the contemporary issues facing science and engineering. (j)
   - Students will learn how to respond to complex ethical situations in science and engineering by integrating historical philosophical theories, legal considerations, professional considerations, and political/justice considerations. (c, f, h, j)

- Students will enhance their ability to design a system, component, or process to meet desired needs within realistic constraints, including economic, environmental, social, political, ethical, security, health, and safety constraints. (c)

a. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course:*
Course addresses ABET Student Outcome(s): c, f, h, j

7. *Brief list of topics to be covered:*
1) Canonical approaches in ethical theory
   - Virtue Ethics: Aristotle's *Nichomachean Ethics.*
   - Egoism & Sovereign Political Authority: Thomas Hobbes' *Leviathan*
   - Natural Law Theory: John Locke's *Second Treatise of Government*
   - Deontology: Immanuel Kant's *Groundwork for the Metaphysics of Morals*
   - Utilitarianism: Jeremy Bentham's *Principles of Morals and Legislation*

   2) Professional Responsibility
   - Professional Responsibility, Part I: Moral problems
   - Professionalism Part II: focus on responsibility for safety.
   - Professional Responsibility part III, focus on trust, character, responsibility
   - Research Ethics
   - Ethics in the Workplace
   - Rights and Responsibilities re: Intellectual Property

   3) The impact of science/engineering on Society and the Impact of Society on Engineering and Science
   - Information Technology
   - Technology and Consumerism: examination of how society impacts science and engineering.
   - Examination of the impact of emerging engineering and scientific practices on society.

Appendix B – Faculty Vitae

Name: Alexandros C. Alkidas

Education:

Ph.D. (M.E.) 1972, Georgia Institute of Technology, Atlanta, Georgia
M. S. (M.E.) 1967, Georgia Institute of Technology, Atlanta, Georgia
B. Sc. (M.E.) 1965, West Ham College, University of London, London, England

Academic Experience:

1997 - Present Adjunct Professor of Mechanical Engineering
1974 -1976 Research Staff Member, Guggenheim Laboratories, Princeton University, Princeton, New Jersey.
1972 -1974 Postdoctoral Fellow, Guggenheim Laboratories, Princeton University, Princeton, New Jersey.
1975 -1976 Consultant, Princeton Research Laboratories, Princeton, New Jersey.

Non-academic Experience:

1986 - 2005 Senior Staff Research Engineer, Powertrain Systems Research Lab., GM R&D Center, Warren, Michigan.
1981 -1986 Staff Research Engineer, Engine Research Department, GM Research Laboratories, Warren, Michigan.
1976 -1981 Senior Research Engineer, Engine Research Department, GM Research Laboratories, Warren, Michigan.

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

Fellow SAE (Society of Automotive Engineers), Member Sigma Xi (honorary)

Honors and Awards:

- Myers Award, SAE Best 2006 Student Paper (SAE Paper 2006-01-1033 -M. Farrugia, and Profs. P. Sangeorzan and A. C. Alkidas) (2007)
- SAE Fellow (2006)
- IMechE Best Paper Award - Vehicle Thermal Management System Conference (VTMS 6) (IMechE Paper C599/100/2003) (2003)
- SAE Best Paper Award - Vehicle Thermal Management Systems Conference (VTMS 5) (SAE Paper 2001-01-1704) (2001)
- SAE Lloyd L. Withrow Distinguished Speaker Award (2000)
- SAE Oral Presentation Award (SAE Paper 1999-01-3580) (1999)
- SAE Forest R. McFarland Award (1996)
- VTMS Conference Oral Presentation Award (SAE Paper 931124) (1993)
- SAE Oral Presentation Award (SAE Paper 910296) (1991)
- SAE Oral Presentation Award (SAE Paper 890144) (1989)
- Rotary Scholarship (1965)

Service Activities:

Service within the Institution

- Thesis and dissertation advisor to SECS graduate students

Service outside of the Institution

- Editor-in-Chief of Society of Automotive Engineers Transactions
- Ph.D. Dissertation examiner (external) for other universities

Most Important Publications and Presentations (in the past five years)
Selected publications are listed below.

- J. Easter, C. Jarrett, C. Pespisa, Y.C. Liu, Oakland University, A.C. Alkidas, L. Guessous, and B. P. Sangeorzan, Oakland University, "An Area-Average Correlation for Oil-Jet Cooling of Automotive Pistons", ASME J. Heat Transfer, Summer 2014.
- "Investigation of the Effects of Autoignition on the Heat-Release Histories of a Knocking SI Engine "Steady-State Heat-Flux Measurements in a Straight-Pipe Extension of an
- Exhaust Port of a Spark-Ignition Engine," *SAE 2007 Transactions – J. Engines*, Section 3, Paper 2007-01-3990, 2007. (with *N. Balzan* and B. P. Sangeorzan)
- "Investigation of the Effects of Autoignition on the Heat-Release Histories of a Knocking SI Engine Using Wiebe Functions," SAE Paper 2008-01-1088, 2008. (with *J. M. Borg*)
- "Combustion Advances in Gasoline Engines," *Energy Conversion and Management*, Vol. 48, pp. 2751-2761, 2007.

Most Recent Professional Development Activities:

- Attend SAE International Congress and Exposition each year.

Name: Gary Barber

Education:

Ph.D., Mechanical Engineering, University of Michigan, 1987.
M.S., Mechanical Engineering, University of Houston, 1982.
B.S., Mechanical Engineering, University of Michigan, 1977.

Academic Experience:

Oakland University, Professor, 08/2001-present, full time
Oakland University, Associate Professor, 09/1994-08/2001, full time
Oakland University, Assistant Professor, 09/1990-08/1994, full time
University of Massachusetts, 09/1986-08/1989, full time

Non-academic Experience:

Detroit Diesel Corporation, Sr Technology Engineer, 09/1989-08/1990
Hayes Machine Company, Design Engineer, 06/1977-08/1979

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

STLE, SME and SAE.

Honors and Awards:

STLE Fellow

Service Activities:

Service within the Institution

- ME Department Undergraduate Committee, Member, 2010-2012.
- ME Department Graduate Committee, 2010-2012.
- ME Faculty Candidate Search Committee, Chair, 2013-2014.
- ME Seminar Committee, Chair, 2011-2012.
- Chair of SECS Committee on Appointments and Promotion (CAP), 2011-2014.
- Oakland University Graduate Council, 2012-2013.
- Oakland University Senate, Member, 2012-2014.
- School of Engineering International Program Coordinator, 2013-2014.
- ME Department Chair, 1999-2010.

Service outside of the Institution

- Associate Editor, Tribology Transactions, 1990-2014.
- Seminar Committee Member, Detroit Section of STLE, 1993-2014.
- Associate Editor, Handbook of Lubrication and Tribology, 2010-2011
- Editor of Automotive Tribology Section of Encyclopedia of Tribology, 2009-2011
- Member of Program Committee, International Seminar on Modern Cutting and Measuring Engineering, 2010.

Most Important Publications and Presentations (in the past five years)
Selected publications are listed below.

- Q. Zou, C. Rao, G. C. Barber, B. Zhou, Y. Wang, "Investigation of surface characteristics and tribological behavior of clutch plate materials", *Wear*, Vol. 302, No. 1-2, pp.1378–1383, 2013.
- S. Kurgin, J. Dasch, D. Simon, G.C. Barber, and Q. Zou, "Evaluation of the Convective Heat Transfer Coefficient for Minimum Quantity Lubrication", Journal of Industrial Lubrication and Technology, 64, 6, 376-386, 2012.
- G. Abed, Q. Zou, G. C. Barber, B. Zhou, Y. Wang, Y. Liu, F. Shi, "Study of the Motion of Floating Piston Pin against Pin Bore", *SAE Int. J. Engines*, 6(2), 2013.
- J. Han, Q. Zou, G. C. Barber, T. Nasir, D. O. Northwood, X. C. Sun, P. Seaton, "Study of the Effects of Austempering Temperature and Time on Scuffing Behavior of Austempered Ni–Mo–Cu Ductile Iron", *Wear*, 290-291, pp. 99-105, 2012.
- R. Zhang, L. Guessous, G. Barber, Investigation of the Validity of the Carslaw and Jaeger Thermal Theory Under Different Working Conditions", Tribology Transactions, 54:1, 122-131, 2011.
- L. Gara, Q. Zou, B. P. Sangeorzan, G. C. Barber, H. E. McCormick, M. H. Mekari, "Wear Measurement of the Cylinder Liner of a Single Cylinder Diesel Engine Using a Replication Method", *Wear*, Vol.268, No.3-4, pp. 558-564, 2010.

Most Recent Professional Development Activities:

- Attend one or two conferences every year including STLE Annual Meetings and SAE World Congress.

Name: Turgay Bengisu

Education:

Wayne State University Detroit, Michigan.	Ph.D Mechanical Engineering	GPA: 3.80	1993
Wayne State University Detroit, Michigan.	MS Mechanical Engineering	GPA: 3.86	1981
University of Strathclyde Glasgow, Scotland.	Postgraduate Diploma Production Engineering & Management	GPA: N/A	1979
Ege University Izmir, Turkey.	BS Mechanical Engineering	GPA: 3.00	1978

Academic Experience:
Oakland University, Adjunct Professor, 8/2005-present

Non-academic Experience:

- General Motors Corporation, Detroit, Michigan. October 1987 – Present: Technical Specialist on dynamic system analysis.
- American Motors Corporation, Detroit, Michigan. June 1986 - October 1987: Product Engineer.
- Silentec Consultants Ltd., Montreal, Quebec, Canada. November 1981 - June 1986: Engineer
- Wayne State University, Detroit, Michigan. October 1979 - September 1981: Research Assistant.

Patents:
N/A

Certifications or Professional Registrations:
PE in Michigan

Most Important Publications: (In last five years)

- Hejie Lin, Turgay Bengisu and Zissimos P. Mourelatos, “Modeling the Stiffness and Damping Properties of Styrene-Butadiene Rubber,” Society of Automotive Engineers, (2009), Paper No: 2011-01-1628.

- Hejie Lin, Turgay Bengisu and Zissimos P. Mourelatos, “Dynamic Properties of Styrene-Butadiene Rubber for Automative Applications,” Society of Automotive Engineers, (2009), Paper No: 09NVC-0080.

Service Activities:
- Member, Acoustical Society of America

- Paper reviewer for several journals on vibrations, noise and signal analysis.

Honors and Awards:
- Method Invention Award, 2005. Crankshaft and Torsional Damper Development Tool, General Motors internal award.
- Method Invention Award, 2006. Piston Noise Analysis Capbility Development, General Motors internal award.
- Method Invention Award, 2013. Mapping Modal Damping to Material Damping by Normal Modes Analysis, General Motors internal award.
- Method Invention Award, 2014. Sleeve Damper Assembly. General Motors patent application.

Most Recent Professional Development Activities:
- GM Internal CAE Conference, every year.
- SAE, Noise and World Congresses, 2009, 2011.

Name: Bhushan Bhatt

Education:

Ph.D. : Oakland University, Rochester, Michigan, 1978
M.E (Mech): Birla Institute of Technology and Science, Pilani, India, 1971
B.E. (Mech): Rajasthan University, India, 1963

Academic Experience:

Oakland University, Professor, 2013- present, half time (on phased retirement)
Oakland University, Professor, 1988-2013, full time
Oakland University, Associate Professor, 1984-1988, full time
Oakland University, Assistant Professor, 1979-1984, full time
Oakland University, Visiting Assistant Professor, 1978-1979, full time
Oakland University, Graduate Assistant, 1974-1978
Birla Institute of Technology and Science, Pilani, India, Lecturer, 1965-1973, full time
Regional Engineering College, Srinagar, India, Junior Lecturer, 1964-1965, full time

Non-Academic Experience:

Oakland University, Acting Associate Dean of Engineering, 1985-1987, full time
Oakland University, Associate Dean of Engineering, 1987-2010, full time

Most Important Publications and Presentations (in the past five years)

- B. L. Bhatt, "Linear Stability Boundary for Simulated Oscillatory Flow Phenomena in Vertical Condensing flows," Paper prepared for submission, 2014.
- B. L. Bhatt, "Simulation of Oscillatory Flow Phenomena in Vertical Condensing Flows inside of a Tube". Paper Number P1275 presedted at IEEE, International Conference on Systems and Infomatics," May 19-21, 2012, Yantai, Shandong, China.

Name: William S. Edwards

Education:
PhDe Mechanical Engineering, Oakland University, 2014e
MSME, Mechanical Engineering, Oakland University, 2003
BSME & BSEE, Electrical & Mechanical Engineering, Oakland University, 1990

Academic Experience:
Oakland University Instructor, 2011 - Present, Part Time
OU Courses taught or scheduled to teach:
- ISE 483/583 Production Systems & Work Flow Analysis
- ISE 341 Ergonomics & Work Station Design
- ISE 484/ME 473 Flexible & Lean Manufacturing
- ISE 441/541 Human Factors
- ISE 485/585 Statistical Quality Contol
- ISE 422/522/ME 478 Robotic Systems
- ISE 595/495 Engineering Program Management

Non-academic Experience:
Chrysler 2008 to 1997; Full Time
President of Chrysler's Native American Employee Resources Group (NAERG); Promoted Cultural Awareness of Native American Culture for Chrysler Employees and Outreach to Communities across the United States.

Advanced Manufacturing Engineering Manager;
Led SWAT test into Chrysler Plants to Quickly Resolution Industrial & Systems Engineering Issues & Implemented Resolutions.

Engine Design Supervisor; Led Award Winning Team in Designing, Developing, & Release of a Global Supercharged Engine for BMW.

Ford Motor Company, 1997 to 1990; Full Time
Design & Release Systems Engine; Awarded Ford Customer Driven Quality Award for Reduction in Engine Warranty. Responsible for Design & Warranty for over 8,000,000 Engine Components around the World.

Eaton Corp(Formerly Lectron Products), 1990 to 1988, Full & Part Time
Junior Engineer, Worked on Electro-Mechanical Devices and Electronically Controlled Hydraulic Values for Vehicle Trans

PDCA Corp, 2008 to 2010
Chief Process Engineer – Direct Operations and Processes.
Focus on Identifying Problems and Implement Resolutions. Employ a Diverse Set of Problem Solving Tools and Occasional Unique Innovative Solutions to Establish Stainable Processes which Optimize and Eliminate Waste.

Certifications or Professional Registrations:

Professional Licensed Engineer (PE License)
Manufacturing Engineering Certification
Society of Automotive Engineers (SAE)
American Indian Science & Engineering Society (AISES)
American Society of Manufacturing Engineering (ASME)
Institute of Electrical and Electronic Engineers (IEEE)

Honors and Awards:

Wards Autoworld,
World's ten (10) best engines award
Ford customer drive quality award
Ford complexity reduction award

Service Activities:

President of Chrysler's Native American Employee Resources Group
Tau Beta Pi; Faculty Advisor
North Oakland Headwater Land Conservancy Boardmember
AISES, Organization Host via Chrysler NAERG

Most Important Publications and Presentations (in the past five years)

INFORMS Symposium,
Managing Production in Rare Event Downtimes
Detroit, MI; September 2013

Most Recent Professional Development Activities:

PhD Expected Completion
INFORMS Presentation

Name: Yin-ping Chang

Education:

Ph.D., Mechanical Engineering, The Pennsylvania State University, USA, 2002
M.S., Mechanical Engineering, National Sun Yat-Sen University, Taiwan, 1992
B.S., Mechanical Engineering, National Sun Yat-Sen University, Taiwan, 1990

Academic Experience:

Oakland University, Associate Professor, 08/2008-present, full time
Oakland University, Assistant Professor, 08/2002-08/2008, full time
The Pennsylvania State University, instructor, 08/1999-05/2002, part time

Non-academic Experience:

MMC branch in Taiwan, Project Manager, 01/1995-08/1995, full time
MMC branch in Taiwan, NVH and EV/HEV Coordinator, 01/1994-12/1994, full time
MMC (Mitsubishi Motor Corporation) branch in Taiwan, Research and Development Division, Southeast Asian Technical Center, Taoyuan, Taiwan, engineer, 08/1992-12/1993, full time

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

ASEE, ASME, SAE, and Tau Beta Pi

Honors and Awards:

- Member of TBP engineering honor society since 2005.
- AcademicKeys Who's Who in Engineering Education (WWEE) in June 2005.
- Recipient of Oakland University Research Excellence Fund, 2004.
- Recipient of Oakland University Faculty Research Excellence Fellowship, 2003.
- Recipient of Mechanical Engineering Graduate Teaching Fellowship for excellence in teaching, The Pennsylvania State University, spring 2000.
- Recipient of University Graduate Scholarship, University of Cincinnati, fall 95 – Spring 96.

Service Activities:

Service within the Institution

- ME Department Undergraduate Committee, Member, 09/2013 – present.
- ME new faculty search committee, Member, 09/2013 – 03/2014.
- ME MS and Ph.D. programs assessment plans Coordinator, 01/2008 – 12/2012.
- ME Department Graduate Committee, Chair, 09/2005 – 08/2006, Member, 09/2002 – 08/2012.
- SECS Executive Committee, Member, 09/2012 – present, 09/2007 – 08/2008, 09/2004 – 08/2005.
- SECS Associate Dean search committee, Member, 09/2010 – 04/2011.
- SECS Committee of Academic Standing, Chair, 09/2009 – 08/2010, Member, 09/2008 – present.
- SECS Graduate Committee, Member, 09/2005 – 08/2006.
- SECS School of Engineering Seminar Series, Chair Assistant, 01/2003 – 08/2003.
- SECS Strategic Planning Task Force Committee, Member, 09/2002 – 08/2003.

- Oakland University Full Year registration Task Force Committee, Member, 01/2009 – 12/2011.
- Oakland University Library Committee, Member, 09/2004 – 08/2006.

Service outside of the Institution

- Member of SAE Tire Tests for Road-Load Tire Model Parameters Task Force Committee, 2006 – present.
- Program Organizer, SAE World Congress Conference, 2006 – 2009.
- Session Chair, ASME IDETC (International Design Engineering Technical Conference), 2005 – 2008
- Session Chair, SAE World Congress Conference, 2004 – 2005.
- Member of ASME Vehicle Design Committee, Mechanical Design Division, 2004 – present.
- Reviewer of journal/conference/NSF proposals.

Most Important Publications and Presentations (in the past five years)
18 publications, and 21 presentations in the past five years. Selected publications are:

- Wu, D. and Chang, Y. P., 2013, "Dynamic Analysis and Simulation of a Double Transition Shift Transmission," *International Journal of Vehicle Performance*, 1(2), 119–136.
- Chang, Y. P. and Her, I., 2013, "A Simple Proof of the Existence of the Collinearity Circle for Force-Input Coupler-Driven Four-Bar," DETC2013-12110, 2013 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Aug. 4-7, 2013, Portland, Oregon.
- Hickman, G. F., Gu, R., and Chang, Y. P., 2013, "Kinematic Modeling and Analysis of a Cam Based CVT," SAE 2013 World Congress Conference, April, 2013, Detroit, MI.
- Chang, Y. P. and Her, I., 2012, "On the Finding of the Collinearity Circle for Force-Input Coupler-Driven Four-Bars," Paper Number: DETC2012-70458, published and presented in 2012 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, August 12-15, 2012, Chicago, Illinois.
- Chang, Y. P. and Kobus, C., 2012, "Teaching Kinematics and Kinetics from A project-Based Experience Analyzing Motion Pictures," IMECE2012-88215, ASME 2012 International Mechanical Engineering Congress & Exposition, Houston, Texas.
- Wu, D. and Chang, Y. P., 2010, "Dynamic Analysis and Parametric Study for Driveability Control of a Double Transition Shifting Process," IEEE 2010 VPPC (Vehicle Power and Propulsion Conference), September 1-3, 2010, Lille, France.
- L Wu, D., Chang, Y. P., and Zhang, Y., 2009, "Dynamic Analysis and Simulation of Driveability and Control of a Double Transition Shifting System," IEEE 2009 VPPC (Vehicle Power and Propulsion Conference), Sept. 7-11, 2009, Dearborn, MI, USA.
- Chang, Y. P. and Her, I., 2008, "A Virtual Cam Method for Locating Instant Centers of Kinematically Indeterminate Linkages," ASME *Journal of Mechanical Design*, 130(6), 062304 (7 pages).

Most Recent Professional Development Activities:

- Attend two or more conferences and seminars every year including ASME IDETC (International Design Engineering Technical Conference), SAE World Congress, ASEE national and regional education seminars and conferences.

Name: Randy Gu

Education:

Ph.D., State Univ. of New York at Buffalo, 1984.
M.S., State Univ. of New York at Buffalo, 1983.
B.S., Department of Applied Math., National Chung-Hsing Univ., Taiwan, 1976.

Academic Experience:

Oakland University, Professor, 2003~present, full time.
Beijing Jiaotong University, China, Visiting Professor, Feb. 2011~Mar. 2011.
Oakland University, Interim Chair, Jan. 2004~May 2004.
Oakland University, Associate Professor, 1991~2003, full time.
National Chung-Hsing University, Taiwan, Visiting Associate Professor, 1990~1991.
Oakland University, Assistant Professor, 1984~1991, full time.
State Univ. of New York at Buffalo, Graduate Assistant, 1980~1984, part time.
National Chung-Hsing Univ., Taiwan, Research Assistant, 1978~1980, full-time,

Non-academic Experience:

Engineering Corp, Army, Taiwan, Second Lieutenant, 1976~1978.
DaimlerChrysler Corporation, Summer Professor, summers of 1995~1998, 2002~2008.
Originatic LLC, Chicago, IL, consultant, 2009~2010.

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

SAE

Honors and Awards:

- Oakland University Research Fellowship, Summer 1991.
- SAE Forest R. McFarland Award, 2004.

Service Activities:

<u>Service within the Institution</u>

- Member, Academic Computing Committee, 1985~1994, 1999~2001.
- Member, Academic Standing and Honor Committee, 1996~1997.
- Chair, Academic Standing and Honor Committee, 1997~1998.
- Member, All University Fund Raising Committee, 1999~2001.
- Member, University Research Committee, 2000~2002.
- Member, Graduate Council, 2000~2004.
- Member, Academic Conduct Committee, 2002~2003.
- Chair, Committee on Academic Standing, 1992~1994.
- Member, Graduate Committee, 1991~1994.
- Member, Committee on Appointment & Promotion, 1997~1999.
- Member, then chair, Committee on Academic Standing, Fall 1997~1999.
- Chair, Graduate Committee, 1999~2000.
- Member, Undergraduate Curriculum Committee, 1999~2001, 1986~1988.
- Member, Dean Search Committee, 2001.
- Member then Chair, Committee on Appointment & Promotion, 2002~2003, 2003-2004.
- Member, Graduate Committee, 2013~present.

- Member/chair, Mechanical Engineering Graduate Affairs Committee, Sept. 1989~2003.
- Chair, ME Chair Search Committee, 2000.
- Chair, ME Graduate Affairs Committee, 2013~present.

Service outside of the Institution

- Board Member, Detroit Chinese Engineers Association, 1990~1993.
- Trustee, Industrial Mathematics Society, 1998~2003.
- Session Chair, Wear, 2002 STLE Annual Meeting, Houston, TX.
- Vice Chair, Computer Tribology Committee, STLE, 2001~2003.
- Member, International Scientific Committee, International Conference on Engineering Optimization - Rio de Janeiro, Brazil, 1-5 July 2012.
- Organizer, CAD/CAM/CAE Technologies, SAE World Congress, 2002~present.
- Session chair, CAD/CAM/CAE Technologies, SAE World Congress, 2002~present.
- Member, Society of Automotive Engineers (SAE), 2010~present.
- Associate editor, *International Journal of Passenger Cars - Mechanical Systems*, 2010 ~ present.

Most Important Publications and Presentations (in the past five years)
Published 5 journal and 9 conference publications, gave 9 presentations in the past five years. Selected publications are listed below.

- Ilie Ilie TĂLPĂŞANU, Pilaka MURTY, Emily HUNT, Randy J. GU, "Transverse Impact of a Cantilever Beam With a Rigid Surface," JOURNAL of the American Romanian Academy of Arts and Sciences, p. 95-, v. 2005-2009, n 29-33.
- R. Gu, L. C. Lev, L. Yang, "Scanning Frequency Ranges of Harmonic Response for a Spot-Welded Copper-Aluminum Plate Using Finite Element Method," Int. J. Passeng. Cars - Electron. Electr. Syst., June 2011 4:174-188.
- J. Song and R. J. Gu, "A Finite Element Based Methodology for Inverse Problem of Determining Contact Forces Using Measured Displacements", Inverse Problems in Science and Engineering, 20(6)(2012), 769-783.
- Nan Xu, Xin Xie, Lianxiang Yang, and Randy Gu, "Nugget Size Measurement In Spot Weld Using Shearography," Int. J. Mater. Manf. 5(1): April 2012, 96-101.
- Randy Gu, Lianxiang Yang, Leo Lev, George Harmon, Nan Xu and Xin Xie, "Determination of Weld Nugget Size Using an Inverse Engineering Technique", SAE Int. J. Passeng. Cars - Mech. Syst. 6(2):2013, doi:10.4271/2013-01-1374.

Most Recent Professional Development Activities:

- Chair annual CAD/CAM/CAE Session, SAE World Congress.
- Design Method Using Knowledge-Based Optimization, Inventors: L. Oriet, Y. Teng, and R. Gu, United States Patent: 7,181,372, March 4, 2004.
- US Patent, Patent Application Publication No. US 2013/0247672 A1, METHOD AND APPARATUS FOR NON-DESTRUCTIVE WELD TESTING, inventors: L. Lev, R. Gu, L. Yang and N. Xu.

Name: Laila Guessous

Education:

Ph.D., University of Michigan, Mechanical Engineering, 1999
M.S., University of Michigan, 1994, Mechanical Engineering, 1994
B.S., North Carolina State University, Mechanical Engineering/Math minor, 1992

Academic Experience:

Oakland University, Associate Professor, 08/2007-present, full time
Changchun University of Technology, China, Visiting Scholar, 5/2013-6/2013, part time
Oakland University, Assistant Professor, 08/2000-08/2007, full time
University of Michigan, Postdoctoral Research Fellow, 09/1999-07/2000, full time

Non-academic Experience:

05/05 – 08/06 DaimlerChrysler Summer Faculty Intern, Auburn Hills, MI
09/92-06/93 Engineering Consultant, Research Triangle Institute, RTP, NC

Certifications or Professional Registrations:

EIT, North Carolina

Current Membership in Professional Organizations:

ASME, SAE, ASEE, SWE, WEPAN and Tau Beta Pi

Honors and Awards: (Partial List)

- Lorrie Ryan Award for Outstanding Poster, 2013 Lilly Conference on College Teaching and Learning, Traverse City, October 2013
- Oakland University Phyllis Law Googasian Award, 2012.
- SECS Outstanding Faculty award for Teaching, Oakland University, 2011
- Honoree, Area of recognition: Service, Oakland University Faculty Recognition Luncheon, April 2008
- SAE Ralph R. Teetor Educational Award, Society of Automotive Engineers, 2007.
- Journal of Heat Transfer Outstanding Reviewer Award, November 2006
- John D. and Dortha J. Withrow Teaching Excellence Award, School of Engineering and Computer Science, Oakland University, 2003
- First Place Best Paper Award, American Society of Engineering Education (ASEE) North Central Spring Conference, April 2002.
- University of Michigan Rackham Predoctoral Fellowship, 1998 - 1999
- National Science Foundation (NSF) Graduate Fellowship, 1994 - 1997

Service Activities:

Service within the Institution (Partial list)

- Past Chair and member of Mechanical Engineering Undergraduate Affairs Committee (MEUAC), 2000-Present (Chair: 1/05 – 9/05 and 1/08 – 12/08)
- Member of SECS Undergraduate Affairs Committee, Fall 2013-present, 2005 and 2008
- Member of SECS Core Council, Fall 2012 – Winter 2013
- Faculty Advisor, Society of Women Engineers (SWE), 2003 – Present
- Member of SECS Committee on Appointments and Promotion (CAP), 2010 –2011
- Member of Oakland University General Education Committee, 08/2013-08/2016

- Chair and past Member, Oakland University Provost Student Research Award Committee, 2006-Present
- SECS member of Oakland University Senate, 2009-Winter 2012
- Chair and past member of Oakland University Research Committee (URC), 2007 – 2011
- Member, Oakland University Academic Conduct Committee, Fall 2011 – Summer 2012

Service outside of the Institution

- Executive Board Member, Michigan Space Grant Consortium, Fall 2012 – Present
- Exhibits/Sponsorship/Publicity Chair of the 2014 ASEE NCS Conference, April 2014.
- Chair or co-chair of 25 technical sessions at various ASME conferences, including ASME IMECE, ASME Summer Heat Transfer Conference, ASME Fluids Engineering Conference, 2003-2013
- Member, K-20 Committee on Computational Heat Transfer, Heat Transfer Division of the American Society of Mechanical Engineering (ASME), 2002 – Present.
- Reviewer of over 120 papers for a number of technical journals and conferences; NSF Panel reviewer

Most Important Publications and Presentations (in the past five years)
Published **7** journal and **14** conference publications, gave **34** presentations in the past five years. Selected publications are listed below.

- Rong Zhang, Laila Guessous and Gary Barber, "Investigation of the validity of the Carslaw and Jaeger thermal theory under different working conditions", Tribology Transactions, 55: 1-11, 2012
- J. Han; R. Zhang; O. O. Ajayi; G.C. Barber; Q. Zou; L. Guessous; D. Schall; S. Alnabulsi, "Scuffing behavior of gray iron and 1080 steel in reciprocating and rotational sliding", *Wear*, 271, pp. 1854-1861, 2011
- Juan D. Tobon, Claire Silverstein, Juan Rueda, Laila Guessous, and Lianxiang Yang, "A Study of Anisotropy and Post-Necking Local Fracture Strain of Advanced High Strength Steel with the Utilization of Digital Image Correlation," *SAE Int. J. Mater. Manuf.* 4(1):1099-1106, 2011.
- Xuwen Zhu, Laila Guessous, L. and Gary Barber, "Numerical Investigation of the Evolution of the Heat Partition Factor During Bolt Tightening," *Tribology Transactions*, 54: 1, 122 -131, 2011
- Shi, Z., Wang, X. and Guessous, L. "Effect of Compression on the Water Management of a PEM Fuel Cell with Different Gas Diffusion Layers," *ASME Journal of Fuel Cell Science and Technology*, vol. 7, 021012, April 2010.
- Kloess, J., Wang, X., Liu, J., Shi, Z. and Guessous, L., "Investigation of Bio-inspired Flow Channel Design for Bipolar Plates in PEM Fuel Cells," *Journal of Power Sources*, Volume 188, Issue 1, pp 132-140, March 2009.

Most Recent Professional Development Activities:

- Attend two or more conferences and seminars every year including ASME IMECE Conference, SAE World Congress, ASME Summer Heat Transfer Conference
- Regularly attend seminars hosted by OU Center for Excellence in Teaching and Learning.

Name: Ching Long Ko (aka: Kent Liaong Ko)

Education:

Ph.D., University of Oklahoma, 1985, Aerospace Engineering
M.S., Oklahoma State University, 1976, Mechanical Engineering
M.S., Oklahoma State University, 1974, Civil Engineering
B.E., Chung Yuan College of Science and Engineering, Taiwan, 1970, Civil Engineering

Academic Experience:

Oakland University, Associate Professor, August 1992 – Present
Oakland University, Assistant Professor, August 1985 – August 1992
Visiting Assistant Professor, University of Oklahoma, 6/1985 - 8/1985
Teaching Assistant, Oklahoma State University, 6/1974 - 5/1978
Mathematics Teacher, Touchiang School of Business, Taipei, Taiwan, 8/1971 - 7/1972

Non-academic Experience:

DaimlerChrysler Summer Faculty Intern, 5/1998 - 8/1998
DaimlerChrysler Summer Faculty Intern, 5/1997 - 8/1997
Chrysler Summer Faculty Intern, 5/1996 - 8/1996
Chrysler Summer Faculty Intern, 5/1995 - 8/1995
Summer Faculty Intern, NASA Lewis Research Center, 5/1990 - 7/1990
Summer Faculty Intern, NASA Lewis Research Center, 5/1989 - 7/1989
Engineering Programming Analyst, Tranter, Inc., 9/1981 - 8/1982
Software Engineer for Flight Simulators, Burtek, Inc., 3/1981 - 8/1981
Systems Analyst, SPS Technologies – Automation, 6/1978 - 2/1981
Reserve Engineering Officer, Taiwanese Air Force, Taiwan, 7/1970 - 7/1971

Certifications or Professional Registrations:

PE, Michigan (Number: 34649)

Most Important Publications and Presentations:

Ko, C. L., "Modified Galerkin Method for Vibrations of Beams with Viscous Damping," AIAA Paper AIAA-2002-1574. (43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Denver, Colorado, April 22-25, 2002)

Ko, C. L., D. E. Boddy, and H. J. Gladden, "Analysis of Developing Laminar Flows in Circular Pipes Using a Higher-Order Finite-Difference Technique," NASA Conference Publication, 10161, pp. 107-114.

Ko, C. L. and H. J. Gladden, "Conjugate Heat Transfer Analysis of Concentric-Tube Heat Exchangers Using a Higher-Order Finite Difference Technique," *Industrial Mathematics, The Journal of Industrial Mathematics Society,* Vol. 48, 1998, pp. 71-100.

Ko, C. L., “Effects of Steady-State and Static Displacements on Free Vibrations of Rotating and Nonrotating Beams,” *Industrial Mathematics, The Journal of Industrial Mathematics Society*, Vol. 48, 1998, pp. 1-40.

Ko, C.L., “An Accurate Finite-Difference Iterative Technique for Solving Nonlinear Partial Differential Equations Using Clustered Grid Points,” *Industrial Mathematics, The Journal of Industrial Mathematics Society*, Vol. 46, 1996, pp. 83-119.

Ko, C.L., “Vibration Analysis of Helicoidal Plates,” *Journal of Mechanical Engineering Science*, Vol. 210, 1996, pp. 501-517.

Ko, C.L. and G.L. Wedekind, “Analysis for the Optimal Performance of Three-Channel Split-Flow Heat Exchangers,” *International Journal of Heat and Mass Transfer*, Vol. 39, 1996, pp. 59-77.

Current Membership in Professional Organizations:

AIAA, Phi Kappa Pi

Service Activities:

Service within the Institution

Member of Oakland University Academic Conduct Committee, 2013-2014
Coordinator of the Engineering Chemistry Program, 1985-2014

Service outside of the Institution

Member of AIAA Technical Committee on Aircraft Design

Most Recent Professional Development Activities:

NSF Workshop on Mechatronics, Rensselaer Polytechnic Institute, New York
NASA Workshop on Computational Fluid Dynamics, Cleveland, Ohio

Name: Chris Kobus

Education:

Ph.D., Oakland University, 1998, Systems Engineering
M.S., Oakland University, 1994, Mechanical Engineering
B.S., Oakland University, 1992, Mechanical Engineering

Academic Experience:

Oakland University, Visiting Professor, August 1998 – August 2000
Oakland University, Assistant Professor, August 2000 – August 2006
Oakland University, Associate Professor, August 2006 – Present

Non-academic Experience:

Engineering Consultant, BorgWarner, Auburn Hills, MI, 05/04-08/04
Layout Engineer, Modern Engineering, Troy, MI, 08/86-06/92

Current Membership in Professional Organizations:

ASME, ASEE, TBP

Honors and Awards:

- OU SECS Teaching Excellence Award, 2014
- OU SECS Service Award, 2013
- Recipient of ASME Heat Transfer Division "certificate of appreciation for valued service," July 2005.
- Recipient of Oakland University Research Fellowship, 2004, 2000.
- Best Overall Paper Award, American Society of Engineering Education (ASEE) North Central Section Annual Conference, 2001.
- Recipient of Michigan Space Grant Consortium Research Fellowship, 2000.

Service Activities:

<u>Service within the Institution</u>

- Chair and member of the School of Engineering and Computer Science Undergraduate Curriculum Committee (UGCC), 2009 – 2013
- Member, Mechanical Engineering Undergraduate Affairs Committee, 2007 – 2014
- Chair, Mechanical Engineering Undergraduate Affairs Committee, 2009 – 2013
- Advisory board to Tau Beta Pi, 2001 – present.
- SECS Director of Outreach and Recruitment, 2011-present
- OUInc Director of Engineering and Energy Education, 2011-present
- Founding Director, Clean Energy Research Center (CERC), 2010-2011.
- OU Center for Excellence in Teaching and Learning, Faculty Fellow, 2013-14
- Co-Chair, OU Assessment Committee, 2013-14
- Member, OU Assessment Committee, 2012-present
- Member, OU Retention Committee, 2012-present
- OU Committee on Instruction (COI); SECS Undergraduate (UG) Representative, 2011 – present

- Member, CETL Faculty Learning Committee on Learning Theories, 2012 – present
- Member, CETL Faculty Learning Committee on Integration of Arts and Sciences, 2012 – present
- Member, CETL Faculty Learning Committee on Campus Engagement and Retention, 2012 – present
- Member, Adviser of the Year Award Committee, 2010.
- Student Marshall, Graduation Commencement Ceremony, 2010 - present

Service outside of the Institution

- Track Chair, Topic Chair, and Session Chair for many ASME Conferences
- Member of ASME HTD K-8, K-21 committees
- Chair, ASME K-21 committee (committee on heat transfer education)
- Member, Automation Alley Education and Workforce Committee, 2011 - present
- Member, Michigan Jobs and Energy Coalition (MJEC), 2011 - present
- Conference Co-organizer of the Michigan Bioenergy Conference, April 26, 2011.
- Green Living Festival (Rochester, MI May 13-15, 2011) sub-committee member of the Oakland County Tech Prep Consortium. Also served on the Green Renewable Energy Outreach sub-committee.

Most Important Publications and Presentations (in the past five years)

- Kobus, C.J., "Utilizing Online Tools For Optimized Delivery Of Distance Learning Material," *ASME 2013 International Mechanical Engineering Congress & Exposition*, November 13-21, San Diego, CA.
- Kobus, C.J., "Storytelling - A Most Powerful Tool In Shaping Lesson Plans In Engineering Education," *ASME 2013 International Mechanical Engineering Congress & Exposition*, November 13-21, San Diego, CA.
- Kobus, C.J., "Modeling Temperature Distributions in a Nuclear Fuel Rod with The Integral Technique," *Proceedings, 2013 American Society of Mechanical Engineers (ASME) Summer Heat Transfer Conference*, July 14-19, Minneapolis, MN.
- Kobus, C.J., "Utilizing The Integral Technique To Determine The Similarity Variable In Classical Heat Transfer Problems – One Dimensional Heat Conduction In A Finite Or Semi-Infinite Solid," *Proceedings, 2013 American Society of Mechanical Engineers (ASME) Summer Heat Transfer Conference*, July 14-19, Minneapolis, MN.
- Kobus, C.J., "On Why The Flipped Classroom Model May Be The Optimum For Heat Transfer Education," *Proceedings, 2013 American Society of Mechanical Engineers (ASME) Summer Heat Transfer Conference*, July 14-19, Minneapolis, MN.
- Kobus, C.J., "True-Temperature Reconstruction from Combined Conduction and Transient Thermocouple Temperature Lag Errors in Single-Phase Convection," *Proceedings, 2013 American Society of Mechanical Engineers (ASME) Summer Heat Transfer Conference*, July 14-19, Minneapolis, MN.
- Chupa, J., Kobus, C.J. (primary technical contributor), and Ganesan, S., "Method for Generating Electric Power From Municipal Waste Water," US Patent#7,915,749, 2011.

Name: Michael Latcha

Education:

Ph.D., Mechanical Engineering, Wayne State University, Detroit MI, August 1989.
MS, Mechanical Engineering, Wayne State University, December 1985.
BS, Mechanical Engineering, Wayne State University, May 1981. With distinction.

Academic Experience:

Oakland University, Associate Professor, 1993-present, full time
Oakland University, Acting Associate Dean, February 2001-November 2001.
Oakland University, Assistant Professor, 1986-1993, full time
Wayne State University, Fellow, Instructor, Teaching and Research Assistant, Department of Mechanical Engineering, 1981-1986

Non-academic Experience:

U.S. Army Summer Faculty Research Engineer, Tank-Automotive Command, Warren, MI. Security Clearance: Secret. Summer 1992-95, 1997, 1999

Certifications or Professional Registrations:

Michigan FE/EIT, 1988

Current Membership in Professional Organizations:

ASME, ASEE and Tau Beta Pi

Honors and Awards:

- Withrow Award for Teaching Excellence, OU-SECS, 1998.
- Engineering Student-Faculty Award for Teaching Excellence, WSU, 1982,83

Service Activities:

<u>Service within the Institution</u>

- SECS Assessment Coordinator, 2001-present
- OU Senate, member
- OU Academic Conduct Committee, chair
- OU-AAUP Executive Committee
- OU-AAUP Negotiating Team: Member 1994, 1997, 2000; Chair 2006, 2009, 2012
- Member of numerous department, school and university committees

<u>Service outside of the Institution</u>

- Reviewer and regional conference organizer, ASEE

Most Important Publications and Presentations (in the past five years)

- Michael Latcha and Mohamed Zohdy, “Melting-Pot Senior Design at OU: 10 Years of Lessons Learned,” Proceedings of the 2014 ASEE North Central Section Conference, 2014
- L. Guessous, Q. Zou, B. Sangeorzan, J.D. Schall, G. Barber, L. Yang, M. Latcha, A. Alkidas and X. Wang, "Engaging Underrepresented Undergraduates in Engineering through a Hands-on Automotive-themed REU Program," Paper # IMECE2013-62111, ASME 2013 International Mechanical Engineering Congress and Exposition, San Diego, CA, November 2013.
- L. Guessous, Q. Zou, B. Sangeorzan, L. Smith, L. Yang, X. Wang, J.D. Schall, G. Barber and M. Latcha,“ AERIM Automotive-themed REU Program : Organization, Activities, Outcomes and Lessons Learned,” Paper AC 2001-1309, 2011 ASEE Annual Conference and Exposition, Vancouver, Canada, June 2011.
- X. Wang, Q. Zou, L. Guessous, G. Barber and M. Latcha, “International Research Experience for Engineering Students in China in the area of Fuel Cells,” Paper AC 2001-1667, 2011 ASEE Annual Conference and Exposition, Vancouver, Canada, June 2011

Most Recent Professional Development Activities:

- Moodle Training, Oakland University e-Lis
- Regularly attend the seminars hosted by the Center for Excellent Teaching and Learning.

Name: Keyu Li

Education:

Ph.D., Johns Hopkins University, Mechanical Engineering, Baltimore, MD, USA (1994)
M.S., Tsinghua University, Engineering Mechanics, Beijing, P. R. China (1988)
B.S., Tsinghua University, Engineering Mechanics, Beijing, P. R. China (1986)

Academic Experience:

Oakland University, Professor, 8/2009 – present.
Oakland University, Associate Professor, 08/1999 – 08/2009.
Tsinghua University, China, Engineering Mechanics, Guest Professor, 5/2004 - 5/2009.
Tsinghua University, China, Engineering Mechanics, Visiting Scholar, 12/2001 - 12/2004.
Oakland University, Assistant Professor, 08/95 – 08/99.
Western Michigan Univ., Assistant Professor, 08/1993 – 08/1995.

Non-academic Experience:

Consulting, Vibracoustic North America, Plymouth, MI, 10/07 – 12/07.
Consulting, University of Tennessee, Materials Science and Engineering, 7/05 – 9/05.
Consulting, Aluminum Company of America, Technical Center, Pittsburgh, PA, 12/96 – 12/97.
Summer Faculty Internship, Chrysler Assembly/stamping Plants, summers of 1995 –1997.

Current Membership in Professional Organizations:

SAE, ASME, SEM, ASEE, ASC.

Honors and Awards:

Beaumont Hospital and Oakland University Multidisciplinary Research Award, 2012.
Recognition of a substantial contribution to SAE technical program, 2005.
Foreign Expert, Certificate issued by State Administration of Foreign Experts Affairs, People's Republic of China, 2004-2009.
Faculty Recognition Award, Oakland University, 2000.
NSF Career Award, 1998.
New Investigator Research Excellence Award, OU, 1997.
Faculty Research Fellowship Award, Oakland University, 1996.
Alcoa Foundation's Science Support Award, 1995, 1996.
Administrative Merit Award, Western Michigan University, 1994.
Faculty Research and Creative Activities Award, Western Michigan University, 1994.

Service Activities:

<u>Service within the Institution</u>

Faculty Re-employment and Promotion Committee (FRPC)
SECS Committee for Appointments and Promotions (CAP).
Search Committees for OU Math and Stats Department, SECS/CSE and SECS/ME Departments.
ME Graduate Committee, Chair, 2007-2008,

Oakland Advisory Board for Manufacturing Engineering Education.

Service outside of the Institution

Chairperson of Residual Stress Technical Division at SEM, 2007-2009.

Organizer and chair, SEM Annual Conference and Exposition on Experimental and Applied Mechanics between 1996 and 2009.

Organizer and co-chair of sessions of SAE in Experiments in Automotive Engineering between 2005 and 2008;

Section co-chair of Optics, the 3rd International Conference on Theoretical and Experimental Mechanics, Beijing, China, Oct. 15-17, 2001;

Session co-chair in the Fifth International Conference on Improvement of Materials, Paris, France, March 25-27, 1996;

Session co-chair of Optical Methods in Vibration and Noise of the 15th ASME Biennial Conference on Mechanical Vibration and Noise, Boston, MA, Sept. 17-21, 1995;

Reviewer for journal, conference papers and NSF proposals.

Most Important Publications and Presentations (in the past five years)

28 Journal and 41 Conference publications; Selected publications are:

- Wang, L., Li, K., Munn, B., and Sanusei, S., “Real-time weld zone strain/slope measurement using the interferometric strain/slope rosette technique,” in press, *International Journal of Experimental Mechanics*,” 2014.
- Wang, L., Li, K., Sanusei, S., Halls, V., and Zheng, J. “Residual stress distribution and characterization on multi-curved armor tiles,” *International Journal of Applied Ceramic Technology,* DOI:10.1111/ijac.12103, pp.1-10, 2013.
- Wang L., Lee, Y., Burger, R., Li, K., “Multiple Sinusoidal Vibration Test Development for Engine Mounted Components,” *Failure Analysis and Prevention*, 2013,13(2), pp 227-240.
- Wang, L., Burger, R., Lee, Y., and Li, K., "Random Vibration Testing Development for Engine Mounted Products Considering Customer Usage," *SAE Int. J. Mater. Manf.* 6(2):254-261, 2013, doi:10.4271/2013-01-1007.
- Xiao, B., Li, K., Wang, Q., Rong, Y., "Numerical simulation and experimental validation of residual stresses in water-quenched aluminum alloy castings," *Journal of Materials Engineering and Performance,* 20(4), pp. 1648-1657, 2011.
- Xiao B., Li, K., Rong, Y., “Automatic determination and evaluation of residual stress calibration coefficients for hole-drilling strain gage integral method,” *STRAIN, An International Journal for Experimental Mechanics,* pages e525–e534, 2011.
- Xiao, B., Wang, Q., Jadhav, P., Li, K., "An Experimental Study of Heat Transfer in Aluminum Alloy Casting during Water Quenching," *Journal of Materials Processing Technology*, 210(14), pp. 2023–2028, 2010.
- Tjhung T. and Li, K., “Deformation and Rigid-body-motion Measurement by Multiple Interferometric Strain/Slope Rosettes, Part I: Theory; Part II: Analysis,” *SEM Experimental Mechanics*, 49(3), 331-339 and 341-352, 2009.

Name: Zissimos P. Mourelatos

Education:

Ph.D., University of Michigan, 1985, Naval Architecture & Marine Engineering
M.S.E., University of Michigan, 1983, Mechanical Engineering
M.S.E., University of Michigan, 1982, Naval Architecture & Marine Engineering
Diploma, National Technical University of Athens, Greece, 1980, Naval Architecture & Marine Engineering / Mechanical Engineering (Dual Degree)

Academic Experience:

Oakland University, Professor, 08/2007-present, full time
Oakland University, Associate Professor, 01/2003-08/2007, full time
University of Michigan, Adjunct Associate Professor, 08/1998-12/2002, part time
University of Michigan, Adjunct Assistant Professor, 08/1992-08/1998, part time
University of Michigan, Adjunct Lecturer, 08/1986-08/1992, part time

Non-academic Experience:

US Army RDECOM TARDEC, Visiting Professor, 05/1009-11/2009, full time
General Motors R&D Center, Staff Research Engineer, 07/1990-12/2003, full time
General Motors R&D Center, Senior Research Engineer, 07/1985-07/1990, full time

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

ASME, AIAA, SAE

Honors and Awards:

- John F. Dodge Chair of Engineering, SECS, Oakland University, 05/2012-present.
- ASME Fellow, 2013, SAE Fellow, 2006.
- SAE Arch T. Colwell Merit Award, awarded twice for two different papers, 2012.
- SAE Lloyd L. Withrow Distinguished Speaker Award, 2007.
- SAE Forest R. McFarland Award, 2008.
- Bill Zimmie Award, University of Michigan, Department of Naval Architecture and Marine Engineering, 2003.
- Outstanding Faculty Member, University of Michigan, Department of Naval Architecture and Marine Engineering, Quarterdeck Award, 1996 and 2000.

Service Activities:

<u>Service within the Institution</u>

- ME Department, Chair, 10/2011-present.
- ME Department Undergraduate Committee, Ex-Officio Member, 8/2010 – present.
- ME Department Graduate Committee, Ex-Officio Member, 8/2010 – present.
- SECS Committee on Appointments and Promotions (CAP), Member, 9/2007 – 8/2010.

<u>Service outside of the Institution</u>

- Member of Organizing Committee, Modeling and Simulation, Testing and Validation Mini-Symposium, 5th Annual Ground Vehicle Systems Engineering and Technology Symposium (GVSETS), 2013.
- Associate Editor, *ASME Journal of Mechanical Design*, 07/2006 -06/2012.
- ASME Design Engineering Division (DED) Nominating Committee, 2011-2012.

- Founding Editor-in-Chief, International Journal of Reliability and Safety, 2004- present.
- Executive Committee, ASME Design Automation Committee (DAC), Chair 2010-2011.
- Program Chair, 2009 ASME Design Automation Conference (DAC), 2009.
- Conference Chair, 2010 ASME Design Automation Conference (DAC), 2010.
- Associate Editor, SAE Journal of Materials and Manufacturing, 2009- present.
- Editorial Board, International Journal of Turbines Engineering, 2009- present.
- Member of Scientific Committee, International Conference on Engineering Design (ICED11 and ICED13), 2011, 2013.
- Member of Scientific Committee, NSF Workshop on "Reliable Engineering Computing," 2004, 2006, 2008, 2010, 2012, 2014.
- Member of Scientific Committee, 2nd International Conference on "Advances in Product Development and Reliability" (PDR 2010), China, 2010.
- Organizer and session chair of multiple SAE, ASME and AIAA sessions.

Most Important Publications and Presentations (in the past five years)
Published 1 book, 1 book chapter, 29 journal and 27 conference articles in past five years.

- V. Pandey and Z.P. Mourelatos, "Rules for Trajectory Updating in Decision Based Design," *Structural and Multidisciplinary Optimization*, 49(1), 49-57, 2014.
- V. Pandey, Z.P. Mourelatos and E. Nikolaidis, "Limitations of Pareto Front in Design under Uncertainty and their Reconciliation," *ASME Journal of Mechanical Design*, 135(7), 071010 (12 pages), 2013.
- Z.P. Mourelatos and E. Nikolaidis, "An Efficient Re-analysis Methodology for Vibration of Large-Scale Structures," *International Journal of Vehicle Design*, 61(1/2/3/4), 86-107, 2013.
- V. Pandey and Z.P. Mourelatos, "A Distributed Pool Architecture for Highly Constrained Optimization Problems in Complex Systems Design," *ASME Journal of Computing and Information Science in Engineering*, 13(3), 031006 (9 pages), 2013.
- D. Drignei and Z.P. Mourelatos, "Parameter Screening in Dynamic Computer Model Calibration using Global Sensitivities," *ASME Journal of Mechanical Design*, 134(8), 081001 (7 pages), 2012.
- E. Nikolaidis, Z.P. Mourelatos and V. Pandey, *Design Decisions under Uncertainty with Limited Information*, CRC Press, Taylor & Francis Group, London, UK, 525 pages, ISBN 978-0-415-49247-8, 2011.
- A. Singh, Z.P. Mourelatos and J. Li, "Design for Lifecycle Cost using Time-Dependent Reliability," *ASME Journal of Mechanical Design*, 132(9), 091008 (11 pages), 2010.
- P. Patel, Z.P. Mourelatos and P. Shah, "Piston Design Using Multi-Objective Reliability-Based Design Optimization," *SAE International Journal of Materials & Manufacturing*, 3(1), 493-511, 2010.

Most Recent Professional Development Activities:
Attend three or more conferences (national and international) each year including SAE World Congress, ASME Design Engineering Conferences and AIAA Structures, Dynamics and Materials (SDM).

Name: Rodrigue Narainen

Education:

Ph.D., Mechanics and Materials, University Technology Compiegne, France, 1993
M.S., Mechanics and Materials, University Technology Compiegne, France, 1988
B.S., Engineering, Institute Polytechnic of Applied Sciences, France, 1986

Academic Experience:

Oakland University, Lecturer, 09/2012-present
Oakland University, Senior Research Associate, 09/2011-present

Non-academic Experience:

General Motors (USA), Manager (Advanced Engineering), 2000 – 2011
Chausson-Outillage (France), Manager (R&D), 1992 – 2000

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

None

Honors and Awards:

Honors and Awards outside of the Institution

- ROI (Record of Invention) on “Computer Optimized Rapid Processing System”, General Motors (USA), 2007
- Great Achievement from Chausson Outillage (France) in developing a unique and innovative system for automatic optimization of dies for sheet metal forming, 1998
- Recognized as an expert for major European automotive industry in applying advanced stamping simulation technology, 1998
- Grant from ANVAR (French National Research Scientist) for numerical development tools for advanced stamping simulation, Chausson-Outillage France, 1994

Service Activities:

Service within the Institution

- OU-Clic-Form (Oakland University - Chrysler Learning Innovation Center) Committee, Member, 09/2012 - present

Service outside of the Institution

- Reviewer of journal/conferences proposal
- Chausson-Outillage (France), Global Research and Development committee, Member, 1993 – 1998
- Chausson-Outillage (France), Industrialization of Research committee, Member, 1993 – 1998

- Member of “Numerical Simulation Stamping Research” regrouping French automotive companies (09/1992 – 1996)

Most Important Publications and Presentations (last 3 years)

- K.S. Raghavan, R. Narainen, L.M. Smith, Experimental and Numerical Study on restraining force development in inclined draw beads, Numisheet technical conference, 2014 Australia
- C. Du, DJ. Zhou, YJ. Zhou, T. Ankofski, R. Narainen, Pre-Strain effects on aluminum sheets edge cracking limit, IABC 2013 Frankfurt (Germany) 2013
- X. Chen, R. Narainen, L, Smith, C. Du, C-K. Hsiung, Pre-forming effect on Edge Cracking in AHSS, IABC-Troy (USA) 2012

Name: Sayed A. Nassar

Education:

Ph.D. University of Cincinnati, 1981, Aerospace Engineering
M.S. University of Cincinnati, 1977, Aerospace Engineering
B.S. Cairo University, Egypt, 1970, Aeronautical Engineering

Academic Experience:

Oakland University, Distinguished Professor, 04/2012-present, full time
Oakland University, Professor, 08/2005-03/2012
Oakland University, Associate Professor, 08/2003-07/2005
Oakland University, Visiting Professor, 09/2000-07/2003
Lawrence Tech. University, Southfield, MI., Professor 09/1988-10/2002
Lawrence Tech. University, Southfield, MI., Associate Professor 08/1985-08/1988

Non-academic Experience:

Chrysler, LLC, Auburn Hills, MI., Summer Intern Professor 05/1999-11/2008
Dow Corning Corp., Midland, MI., Senior Stress Analyst (contract) 07/1984-07/1985
Bechtel Power Corp., Ann Arbor, MI., Senior Stress Analyst (contract) 04/1981– 07/1984

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

Fellow ASME, member SAE
Guest Editor, ASME Journal of Pressure Vessel Technology

Honors and Awards:

- Research Award (2013), School of Engineering and Computer Science, Oakland University.
- Distinguished Professor Rank (2012), Oakland University.
- Achievement Award (2011), NASA Engineering Safety Center.
- ASME Best Technical Paper (2011), PVP Conference.
- Emeritus Professor of Mechanical Engineering (2002), Lawrence Technological University, Southfield, MI.

Service Activities:

<u>Service within the Institution</u>

- Member, ME Department Graduate Committee (2013- present).
- Member, University Provost Search Committee (2012-2013).
- Chair, SECS Research Support Committee (2012).
- Coordinator, ME Research Seminar Series (2010-2011).
- Chair, SECS Dean Search Committee (2008-2009).

<u>Service outside the Institution</u>

- Member, NASA-wide team (2007-2011) that developed the new threaded fastener systems' standard for the US space flight hardware NASA-STD-5020.
- Guest Assoc. Editor, ASME Journal of Pressure Vessel Technology (2006).
- Co-Editor, ASME-PVP peer-reviewed Proceedings (2006-present)

- ASME Topic/Symposium Organizer, Session Developer/Chair/ Co-Chair (2006-present)
- Reviewer (ASME: Journals of PVT, MD, and PVP conferences)
- Technical Conference participation (ASME: 2006-present, SEM: 2012)
- Tutorial Developer and Instructor: ASME-PVP2013: developed and taught tutorial to international conference participants in Paris, France.
- Developed and taught 8 short courses to industry in the US, Spain, and China (2009-present).

Most Important Publications and Presentations (in the past five years)
In addition to the limited sample of 14 journal publication listed below, this activity also includes 45 conference paper presentations and invited seminars:

- Mao, J., Nassar, S.A., Yang, X., "Fracture Model for Adhesively Bonded Joints", 2014, *Journal of Adhesion Science and Technology*, vol. 28, Issue 6, pp. 613-629.
- Ganeshmurthy, S. and Nassar, S. A., "Finite Element Simulation of Various Process Control Methods for Bolt Tightening", 2014, *Journal of Manufacturing Sciences and Engineering-ASME Transactions*, vol. 136 (2), pp. 221018-1~9.
- Nassar, S.A. and Ali, R. "An Improved Cumulative Damage Criterion for Preloaded Threaded Fasteners", 2013, *Journal of Mechanical Design- ASME Transactions,* in press.
- Zaki, A.M., Nassar, S. A., Yang, X., "Effect of Conical Angle and Thread Pitch on the Self-Loosening Performance of Preloaded Countersunk-Head Bolts", 2012, *Journal of Pressure Vessels Technology -ASME Transactions*, vol. 134, no. 1, pp. 021210-1~8.
- Housari, B., Alkelani, A., Nassar, S. A., "A Proposed Model for Predicting Residual Clamp Load in Gasketed Bolted Joints", 2012, *Journal of Pressure Vessel Technology-ASME Transactions,* vol. 134, no.1, pp. 021201-1~5.
- Yang, X., Nassar, S.A., Wu, Z., Meng, A., "Nonlinear Behavior of Preloaded Bolted Joints Under a Cyclic Separating Load", 2012, *Journal of Pressure Vessel Technology-ASME Transactions,* vol. 134, no.1, pp. 011206-1~9.
- Nassar, S. A., Mao, J., Yang, X., and Templeton D., "A Damage Model for Adhesively Bonded Single-Lap Thick Composite Joints", 2012, *Journal of Engineering Materials and Technology-ASME Transactions,* in press.
- Abboud, A., and Nassar, S. A., "Viscoelastic Strain Hardening Model for Gasket Creep Relaxation", 2011, *Journal of Pressure Vessel Technology-ASME Transactions,* in press**.**
- Nassar, S.A., and Ganganala, M., "Effect of Separating Load Eccentricity on the Clamp Load Loss in a Bolted Joint Using a Strain Hardening Model", 2011, *Journal of Pressure Vessel Technology-ASME Transactions,* vol. 133, pp. 021206-1~8.
- Nassar, S.A., Yang, X., Gandham, S., Wu, Z., "Nonlinear Deformation Behavior of Clamped Bolted Joints under a Separating Service Load", 2011, *Journal of Pressure Vessel Technology, ASME Transactions,* vol.133, pp.021001-1~9.
- Wu, Z., Nassar, S. A. and Yang, X., "Pullout Performance of Self-Tapping Medical Screws", 2011, *Journal of Biomechanical Engineering-ASME Transactions*, vol. 133, pp. 111002-1~9.
- Yang, X., Nassar, S.A., Wu, Z.**,** "Criterion for Preventing Self-Loosening of Preloaded Cap Screws Under Transverse Cyclic Excitation", 2011, *Journal of Vibrations and Acoustics-ASME Transactions*, vol. 133, pp. 041013-1~11.

Name: Johann Pankau

Education:

M.S., Applied Mechanics, Technical University of Darmstadt, Germany, 1996 - 1990
M.S., Civil Engineering, Technical University of Bydgoszcz, Poland, 1980 - 1985

Academic Experience:

Oakland University, Lecturer, Part time, 1/2010-present
Technical University of Darmstadt, Germany, Scientific Assistant, 9/1986-2/1990

Non-academic Experience:

Automotive Industry in Germany and US:

Comprehensive technical experience in Chassis technology: Suspension, Tires, Brakes, Safety Systems, Vehicle Dynamics and NVH, CAD, CAE

ITT Teves, Germany:

Test Engineer, Mar 1990 – Aug 1992

Supervisor, CAE & Brake Rotor Development**,** Sept 1992 – Mar 1998
Continental Teves, ITT Teves North America, April 1998 – Mar 2000

Engineering Specialist, Computer-Aided Engineering:

Continental Teves North America, Apr 2000 – Jul 2003
Manager NVH Center, Continental Tire North America, 2003-present
Manager Profit Center: NVH (Noise Vibration Harshness) Engineering Services

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

SAE

Honors and Awards:

Non

Most Important Publications and Presentations (in the past five years)

<u>Publications:</u>

Computational Optimization of the Brake Rotor, ATZ	1992
Suspension Sensitivity Investigation, Steering Wheel Oscillations Induced by Brake Judder, VDI Berichte NR.1791	2003
Suspension Sensitivity Investigation, Steering Wheel Oscillations Creep Groan Noise Phenomena & Optimization, ATZ	2004
Vehicle Vibrations & Steering Wheel Oscillations induced by Tire Non-Uniformity or Brake Judder, VDI-Berichte NR. 575	2004

<u>Lectures:</u>

μ-Symposium, Germany: Brake Rotor Development	1996
SAE Brake Colloquium, USA: New approaches in Brake Rotor Development	1997
SAE Brake Colloquium USA: CAE methods and NVH in brake development	1998

VDI Colloquium, Germany: Suspension sensitivity Investigation: Steering Wheel Oscillations

Induced by Brake Judder 2003

μ-Symposium, Germany: Vehicle Vibrations & Steering Wheel Oscillations induced by Tire Non-uniformity or Brake Judder 2004

SAE Brake Colloquium, USA: Vehicle / Suspension Sensitivity Investigation / Steering Wheel Oscillations induced by Brake Judder 2004

Most Recent Professional Development Activities:

CAE Courses: I-DEAS FEM	1994
I-DEAS Test	1995
ABAQUS Standard	1996
ABAQUS Explicit	1996
Self and Time Management; Stoeger & Partner	1994
Changes in Industry and Requirements for Management: Stoeger & Partner	1996
Team Leadership, Interpersonal Effectiveness; Oakland University	2000
MBA Course; American Management Association	2004
Team Dynamic & Successful Cooperation; Breuel & Partner	2005
Successful Product Management: American Management Association	2006
“Rhetorik” advance training: Lubbers/Contur GmbH, Germany	2008

Name: Brian P. Sangeorzan

Education:

Ph.D., Mechanical Engineering, University of Wisconsin-Madison, Ph. D, 12/1983
B.M.E., Mechanical Engineering, University of Detroit, 1975

Academic Experience:

Oakland University, Professor, 08/2013-present, full time
Oakland University, Associate Professor, 08/1990-08/2014, full time
Oakland University, Assistant Professor, 12/1983 – 8/1990, full time
Oakland University, Visiting Assistant Professor, 1/1983 – 12/1983, full time

Non-academic Experience:

05/98-08/98 Senior Technical Specialist, FEV Engine Technology, USA
05/95-08/95 Chrysler Summer Faculty Manufacturing Internship Program
05/96-08/96 Chrysler Summer Faculty Manufacturing Internship Program
05/94-08/94 U.S. Army Tank Automotive Command (TACOM), Summer Fellowship, Warren, MI. Also: 05/93-08/93, 05/91-08/91, 05/90-08/90, 05/89-08/89
09/1998 – Present Consultant, FEV Engine Technology, Auburn Hills, MI
05/2006- 12/2006 Consultant, MicroHeat Corp., Farmington Hills, MI
01/2004- 04/2004 Consultant, PCE USA, Auburn Hills, MI
05/92-08/92 Consultant, GM Research Labs, Warren, MI

Certifications or Professional Registrations:

PE, Wisconsin

Current Membership in Professional Organizations:

ASME, ASEE, SAE, and Tau Beta Pi

Honors and Awards:

- 2012 SECS *Outstanding Faculty for Teaching Award* – The OU School of Engineering and Computer Science annual award for excellence in teaching.
- 2011 SAE Detroit Section Chairman
- 2012 SECS (first) Outstanding Faculty for Service Award. This was the first annual OU School of Engineering Service Award.
- 2008 Oakland University Best Thesis Award. Awarded to Noel Balzan for his M.S. Thesis, under my supervision.
- 2006 SAE Myers Award for Best Student Paper (co-author with Ph.D. student Mario Farrugia and Dr. Alex Alkidas) (Awarded in 2007)
- *John D. and Dortha J. Withrow Award for Teaching Excellence* (2004), Oakland University SECS
- Special Recognition Award from the Detroit Section SAE, for activities at the national level, the Detroit Section and as faculty advisor. (2001)
- Recognition at the Founders' Day 2001 Faculty Recognition Luncheon, for service to the SECS
- Naim and Ferial Khier Teaching Excellence Award (Sept. 2001), Oakland University SECS.
- Nominated for Oakland University Teaching Excellence Award, 2000
- SAE Outstanding Faculty Advisor Award (Feb. 1997 and Feb. 1993)
- 1988 Ralph R. Teetor, Outstanding Engineering Educator Award. Awarded by SAE

- *1987-1988 Faculty "Link Award"*, for service to a student organization at Oakland University

Service Activities:

Service within the Institution

- Numerous service roles within the SECS, including: chair of the SECS Undergraduate Affairs Committee (UAC), Chair of the Mechanical Engineering Undergraduate Affairs Committee (MEUAC), chair of SECS Committee on Appointments and Promotions (CAP), Faculty Advisor, SAE Student Chapter, and chair of many Mechanical Engineering Faculty Search Committees
- Numerous university committees including: Academic Conduct Committee, Graduate Council and University Senate

Service outside of the Institution

- Numerous governing board positions within the SAE Detroit Section, including: Chairman (2011), Executive Vice Chair for Meetings, Vice Chair for Math and Science K-12, Vice Chair for Student Relations, Assistant Vice Chair for Special Programs and Vice Chair for Younger Member Relations,
- Organizer, Chair or Co-Chair for several technical sessions at professional meetings for SAE, ASEE, STLE and AIAA (various dates)
- Reader (reviewer) SAE Transactions in the areas of Diesel Engines, Advanced Powerplants, Engine Heat Transfer, and SI Engine Combustion
- Numerous SAE International positions including: SAE Scholarship Committee, SAE Phil and Jean Myers Award Committee, SAE Faculty Advisors Committee 1999-present, meets once per year at the SAE Congress, SAE Engineering Education Board, Non-Financial Audit Sub-Committee and SAE ABET Relations Committee.

Most Important Publications and Presentations (in the past five years)

Approximately 25 journal and conference publications. Space limits the list below.

- J. Easter, C. Jarrett, C. Pespisa, Y.C. Liu, Oakland University, A.C. Alkidas, L. Guessous, and B. P. Sangeorzan, Oakland University, "An Area-Average Correlation for Oil-Jet Cooling of Automotive Pistons", ASME J. Heat Transfer, Summer 2014.
- L. Guessous, Q. Zou, B. Sangeorzan, J.D. Schall, G. Barber, L. Yang, M. Latcha, A. Alkidas and X. Wang, "Engaging Underrepresented Undergraduates in Engineering through a Hands-on Automotive-themed REU Program," Paper # IMECE2013-62111, ASME 2013 International Mechanical Engineering Congress and Exposition, San Diego, CA, November 2013.
- Inman, K., Wang, X. and Sangeorzan, B., "Design of an Optical Thermal Sensor for Proton Exchange Membrane Fuel Cell Temperature Measurement using Phosphor Thermometry," Journal of Power Sources, Vol. 195, Issue 15, pp. 4753-4757, 2010.
- Q. Zou, L. Gara, B. Sangeorzan, G. Barber, H. McCormick, M. Mekari, "Wear Measurement of the Cylinder Liner of a Single Cylinder Diesel Engine Using Replication Method", Wear, vol. 268, pp. 558–564, 2010, Elsevier.

Most Recent Professional Development Activities:

- Attend at least one conference and seminars every year such as the SAE World Congress and SAE Detroit section education seminars and technical meetings.
- Regularly attend the seminars hosted by the Center for Excellent Teaching and Learning.

Name: J. David Schall

Education:

2004	North Carolina State University	Ph.D., Materials Science and Engineering
2000	North Carolina State University	M.S., Materials Science and Engineering
1997	North Carolina State University	B.S., Materials Science and Engineering

Academic Experience:

2009-present Oakland University, Department of Mechanical Engineering, Assistant Professor
2004-2009 US Naval Academy, Department of Chemistry, Assistant Research Professor

Non-academic Experience:

1995-1997 IBM Research Triangle Park, Materials Analyst

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

STLE, SME, AVS

Honors and Awards:

None

Service Activities:

Service within the Institution

- Search Committee Chair, CAD/M search, Winter 2014.
- Departmental Seminar Series Organizer, 2013 to present
- Mechanical Engineering Grad. Committee**,** Chair – Fall 2011 to 2013, Member–2009 to present.
- Executive Committee, 2009 to 2013
- SECS Graduate Committee, Chair, Fall 2012 to Winter 2013.
- University Graduate Council - Winter 2013

Service outside the Institution

- Co-guest editor "Tribology of Carbon-Based Coatings" (Special Issue) Lubrication, to be published in 2014.
- Society of Tribologists and Lubrication Engineers (STLE) Tribology Minicamp. May 6th, 2013.
- 2014 Chair – Tribology Focus Session, American Vacuum Society
- 2013 Co-chair – Tribology Focus Session, American Vacuum Society
- 2013 Chair - Surface Engineering Technical Committee, Society of Tribologists and Lubrication Engineers
- 2012 Vice Chair - Surface Engineering Technical Committee, Society of Tribologists and Lubrication Engineers
- 2011 Secretary - Surface Engineering Technical Committee, Society of Tribologists and Lubrication Engineers
- 2010 Paper Solicitation Chair - Surface Engineering Technical Committee, Society of Tribologists and Lubrication Engineers

- Manuscript Review for Journal of Tribology, Modeling and Simulation in Materials Science, Tribology Transactions, Tribology International, and Journal of Physics: Condensed Matter, Journal of Engineering Tribology, and Materials Evaluation.

Most Important Publications and Presentations (in the past five years)
Published 7 journal and 9 conference publications, gave 24 presentations in the past five years. Selected publications are listed below.

- Schall, J. David, "Journal Keeping in Engineering," paper number 44, ASEE North Central Section Conference 2014, April 4-5, 2014, Rochester MI. (accepted).
- Daly Flynn, K., Schall, J. David, "Comparison of Tribological Performance of WS2 Nanoparticles, Microparticles and Mixtures Thereof." Paper number 2014-01-0949, SAE World Congress, April 18-20th, 2014.
- Robert V. Petrach III, James David Schall, Qian Zou, Gary Barber. Randy Gu, Laila Guessous, "Microstructural Contact Mechanics Finite Element Modeling Used to Study the Effect of Coating Induced Residual Stresses on Bearing Failure Mechanisms" Paper number 2014-04-01, SAE World Congress, April 18-20th, 2014.
- L. Guessous, Q. Zou, B. Sangeorzan, J.D. Schall, G. Barber, L. Yang, M. Latcha, A. Alkidas and X. Wang, "Engaging Underrepresented Undergraduates in Engineering through a Hands-on Automotive-themed REU Program," Paper # IMECE2013-62111, ASME 2013 International Mechanical Engineering Congress and Exposition, San Diego, CA, November 2013.
- Ionut Harta, Kayla Owens, Steven De Jesús Santiago, David Schall, Steven Thrush, Gary Barber, Qian Zou, "Tribological performance of ZnO-oil nanofluids", SAE International Journal of Fuels and Lubricants, 6(1):2013 pg. 126.
- J. David Schall and Judith Harrison, "A Reactive Bond-Order Potential for Si-, C-, and H-Containing Materials", Journal of Physical Chemistry C, 2013, 117 (3), pp 1323–1334.
- Jiman Han; Rong Zhang; Oyelayo O Ajayi; Gary Barber; Qian Zou; Laila Guessous; David Schall; S. Alnabulsi, "Scuffing behavior of gray iron and 1080 steel in reciprocating and rotational sliding", Wear of Materials, Volume 271, Issues 9–10, 29 (2011), Pages 1854–1861.
- Paul T. Mikulski, Kevin Van Workum, Ginger M. Chateaueuf, Guangtu Gao, J. David Schall, and Judith A. Harrison, "The Effects of Interface Structure and Polymerization on the Friction of Model Self-Assembled Monolayers" Tribology Letters, Volume 42, Number 1 (2011), 37-49.

Most Recent Professional Development Activities:
Attend two or more conferences and seminars every year including the annual meetings of the Society of Tribologists and Lubrication Engineers, American Vacuum Society, and Materials Science and Technology

Name: Arun S. Solomon

Education:

1984	Ph.D.	Mech. Eng., Penn State University, State College, PA, USA.
1982	M.S.	Mech. Eng., Penn State University, State College, PA, USA.
1980	B.E.	Mech. Eng., College of Engineering, Guindy, Madras, India.

Academic Experience:

2010-present	Adjunct Lecturer, Mech. Eng. Dept., Oakland University, Rochester, MI.
1995-present	Guest lectures at Michigan State Univiersity's "Automotive Engines" course.
1989-1997	Adjunct Assoc. Professor, M. E. Dept., Wayne State University, Detroit, MI.
1986-1989	Adjunct Lecturer, M.E. Dept., Lawrence Technological University, Southfield, MI.

Non-academic Experience:

2000-present	Technical Fellow, Powertrain Systems Res. Lab., GM R&D, Warren, MI.
1994-1998	Section Manager, Engine Research Dept., GM R & D Center, Warren, MI.
1988-2000	Staff Research Engineer, GM Research Laboratories, Warren, MI.
1984-1988	Senior Research Engineer, GM Research Laboratories, Warren, MI.
1980-1984	Research Assistant, M.E. Dept., Penn State University, State College, PA.

Certifications or Professional Registrations:
None

Current Membership in Professional Organizations:
SAE

Honors and Awards:
- National Merit Scholarship, India, 1974.
- Conference Award - Best Paper 22nd ASME/AIChE National Heat Transfer Conference, 1984.
- Certificate of Merit - paper presented at the AIAA 22nd Aerospace Sciences Meeting, 1984.
- Excellence in Oral Presentation Award, SAE, 1986.
- Outstanding Young Engineer Award (Southeastern Michigan region), ASME, 1988.
- Arch T. Colwell Merit Award, SAE, 1989.
- Ralph R. Teetor Industrial Lectureship Award, SAE, 1990-91.
- Best Teacher Award, College of Engineering, Wayne State University, 1990-91.
- McFarland Award, SAE, 1998.
- Spontaneous Appreciation Award for Advanced Engine Technolgy Plan, December, 1999.
- Special Recognition Award, United States Council for Auotmotive Research (USCAR), 2010.

Service Activities:
<u>Service within the Institution</u>
None
<u>Service outside of the Institution</u>
- GM R&D Committee for Technical and Educational Programs (CTEP) 1992-93.

- GM Combustion Center of Expertise (COE) 1993-95.
- GM Dilute Combustion Working Group and Steering Committee 1994-1996.
- GMPT/GM R&D Taskforce on Advanced Gasoline Engine Technology Plan for GM – 1999.
- Cooperative Research - National Labs (Sandia and Oakridge), and Universities (Wisconsin and Michigan), 2002 – present.
- Founding member of Science Lab Technical Council, GM R&D, 2004-2006.
- Industry Representative, United States Council for Automotive Research (USCAR), Advanced Combustion, Emissions and Control (ACEC) Tech Team, 2007 – present.
- Department of Energy (DOE) Annual Merit Reviewer of Programs, 2008 – present.
- Vice-Chairman, Science Lab Technical Council, GM R&D, 2011.
- Chairman, Science Lab Technical Council, GM R&D, 2012.
- Younger Member Activity, Detroit Section SAE, 1985-1989.
- Organizer, Direct-Injection Gasoline Engines Session, SAE Congress 1995-1998.

Most Important Publications and Presentations (in the past five years)
I am unable to list my GM-internal publications and presentations.

- James D. Smith, Gerald A. Szekely, Jr., Arun S. Solomon, and Scott M. Parrish, "A Comparison of Spray-Guided Stratified-Charge Performance with Outwardly-Opening Piezo and Multi-hole Solenoid Injectors," SAE Paper No. 2011-01-1217, 2011.
- Carolyn Farron, Nicholas Matthias, David Foster, Michael Andrie, Roger Krieger, Paul Najt, Kushal Narayanaswamy, Arun Solomon, and Alla Zelenyuk, "Particulate Characteristics for Varying Engine Operation in a Gasoline Spark Ignited, Direct Injection Engine," SAE-2011-01-1220, SAE International, Warrendale, Pennsylvania, USA, 2011.
- Nicholas Matthias, Carolyn Farron, David Foster, Michael Andrie, Roger Krieger, Paul Najt, Kushal Narayanaswamy, Arun Solomon, and Alla Zelenyuk, "Particulate Matter Sampling and Volatile Organic Compound Removal for Characterization of Spark Ignited, Direct Injection Engine Emissions," JSAE 20119383, SAE-2011-01-21000, Society of Automotive Engineers of Japan, 2011.
- Xiaofeng Yang, Arun Solomon, and Tang-wei Kuo, "Ignition and Combustion Simulation of Spray-Guided SIDI Engine using Arrhenius Combustion Model with Spark-Energy Deposition Model," SAE-2012-01-0147, SAE International, Warrendale, Pennsylvania, USA, 2012. (Also in SAE-SP-2331).
- Rainer N. Dahms, Michael C. Drake, Todd D. Fansler, Ronald O. Grover Jr., and Arun S. Solomon, "Detailed Simulations of Stratified Ignition and Combustion Processes in a Spray-Guided Gasoline Engine Using the SparkCIMM/G-Equation Modeling Framework," SAE 2012-01-0132, Also in SAE-SP-2331, SAE International, Warrendale, Pennsylvania, USA, 2012.

Most Recent Professional Development Activities:
Attend several conferences, seminars, or symposiums every year including SAE World Congress, SAE High Efficiency Engines Symposium, DOE Annual Merit Review, USDRIVE technical meetings and several GM-internal technical meetings and educational seminars.

Name: Xia Wang

Education:

Ph.D., Mechanical Engineering, Rensselaer Polytechnic Institute, Troy, NY, Dec 2003
M.S., Thermal Eng., University of Science and Technology Beijing, China June 2000
B.S., Thermal Eng., University of Science and Technology Beijing, China, June 1997

Academic Experience:

Oakland University, Associate Professor, 08/2011-present, full time
Oakland University, Assistant Professor, 01/2005-08/2011, full time
Rensselaer Polytechnic Institute, Postdoctoral Research Associate, 01/04-12/04, full time

Non-academic Experience:

None

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

ASEE, ASME, ECS and SAE

Honors and Awards:

- Recipient of SAE Ralph Teetor Educational Award, Society of Automotive Engineering, 2011.
- Honoree of Oakland University Faculty Recognition Luncheon (Research), April 2011.
- Recipient of New Investigator Research Excellence Award, Oakland University, 2010.
- Recipient of Outstanding Service Award by International Association of Hydrogen Energy, 2009.
- Recipient of Faculty Research Fellowship, Oakland University, 2006, 2008 and 2012.
- Recipient of Robert t. Knapp Best Paper Award from ASME Fluid Dynamics Division, 2002.

Service Activities:

<u>Service within the Institution</u>

- ME Department Undergraduate Committee, Member, 08/2005 – 08/2007, 08/2012 – present.
- ME Department Graduate Committee, Chair, 08/2008 – 04/2011, Member, 8/2011 – 8/2012.
- ME Faculty Candidate Search Committee, Member, Winter 2008
- SECS Graduate Committee, Fall 2008-Winter 2011
- SECS Committee of Academic Standing, Member, Fall 2007-Winter 2010
- Oakland University Research Committee, Fall 2013-present
- Oakland University Faculty Re-employ and Promotion Committee, Fall 2013-present
- Faculty Advisor of the International Association for Hydrogen Energy(IAHE)-Student Chapter (OU is the second student chapter in the US, with around 25 student members; and OU IAHE student chapter won the third place in the 1st IAHE design project competition), Winter 2009-Present.

<u>Service outside of the Institution</u>

- Faculty advisor of Imagineering Program at Quarton Elementary School, Birmingham, MI: Winter 2005-present (with Dr. Sangeorzan)
- Officers of the Electrochemical Society, Detroit section, Chair (2010-2011), Vice-chair(2009-2010), Secretary(2008-2009), and Treasurer(2007-2008)
- Track co-organizer for Symposium on Applications in CFD at ASME 2014 4th Joint US-European Fluids Engineering Division summer meeting, August 3-7, 2014, Chicago, Illinois.
- Track co-organizer and session chair at ASME 2014 12th Fuel Cell Science, Engineering and Technology Conference, June 30-July 2, 2014, Boston, USA.
- Session chair at ASME 2013 11th Fuel Cell Science, Engineering and Technology Conference, July 14-19, 2013, Minneapolis, MN, USA.
- Track co-organizer for Symposium on Applications in CFD at ASME 2013 3rd Joint US-European Fluids Engineering Division summer meeting, July 7-11, 2013, Incline Village, Nevada.
- Reviewer of journals/conferences/NSF proposals/Hongkong Research Council proposals.

Most Important Publications and Presentations (in the past five years)
Published **17** journal and **16** conference publications, gave **26** presentations in the past five years. Selected publications are listed below.

- Xu, M., Zhang, Z., Wang, X. Jia, L. and Yang, L., "Two Dimensional Electrochemical-thermal coupled modeling of cylindrical LiFePO4 batteries," Journal of Power Sources, Vol. 256, pp. 233-243, 2014.
- Bazinski S. J. and Wang, X., "The Influence of Cell Temperature on the Entropic Coefficient of a Lithium Iron Phosphate (LFP) Pouch Cell," Journal of the Electrochemical Society, Vol. 161, Issue 1, A168-A175, 2014.
- Inman K. and Wang, X., "In-Situ Temperature Measurement on Cathode GDL in PEMFC Using an Optical Fiber Temperature Sensor," Journal of the Electrochemical Society, Vol. 160, Issue 6, F496-F500, 2013.
- Clement, J. and Wang, X., "Experimental Investigation of Pulsating Heat Pipe Performance with Regard to Fuel Cell Cooling Application," J. of Applied Thermal Engineering, Vol. 50, Issue 1, pp.268-274, 2013.
- Petrach, E., Abu-Isa, I. and Wang, X., "Percolation threshold study of a plastic-elastomeric matrix based composite material for bipolar plates in proton exchange membrane fuel cells," J. of Composite Materials, Vol. 46, No. 23, pp.2959-2971, 2012.
- Shi, Z. and Wang, X., "Pore Structure Modeling of Flow in Gas Diffusion Layers of Proton Exchange Membrane Fuel Cells," ASME Journal of Fuel Cell Science and Technology, Vol. 9, 021001-021007, 2012.
- Inman, K., Wang, X. and Sangeorzan, B., "Design of an Optical Thermal Sensor for Proton Exchange Membrane Fuel Cell Temperature Measurement using Phosphor Thermometry," Journal of Power Sources, Vol. 195, Issue 15, pp. 4753-4757, 2010.

Most Recent Professional Development Activities:

- Attend two or more conferences and seminars every year including ASME Fuel Cell Science, Engineering and Technology Conference, Electrochemical Society Annual Meetings.
- Regularly attend the seminars hosted by the ECS Detroit, and other local industries.

Name: Lianxiang Yang

Education:

Ph.D., Mechanical Engineering, University of Kassel, Germany, 1997
M.S., Precision Mechanical Engineering, Hefei University of Technology, China, 1986
B.S., Precision Mechanical Engineering, Hefei University of Technology, China, 1982

Academic Experience:

Oakland University, Professor, 08/2008-present, full time
Oakland University, Associate Professor, 10/2001-07/2008, full time
University of Kassel (Germany), Research Fellow, 11/1994-10/1998, full time
University of Kassel (Germany), Research Fellow, 11/1991-10/1994, part time
Hefei University of Technology (China), Associate Professor, 01/1991-10/1991, full time
Hefei University of Technology (China), Lecturer, 09/1986-12/1990, full time

Non-academic Experience:

Dantec-Dynamics GmbH (Germany), Consultant, 01/2003-present
DaimlerChrysler Corporation (USA), Summer Professor, May to August from 2003-2008
JDS-Uniphase Corporation (Canada), R&D Scientist, 03/2000-10/2001, full time
Ettemeyer GmbH (Germany), Senior Engineer, 11/1998-02/2000, full time

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

Fellow of SPIE, Member of ASNT, SAE, and SEM

Honors and Awards:

- Recipient of the Forest R. McFarland Award of SAE, 2013
- Recipient of the Academic Excellence Recognition Award of Oakland University, 2011.
- SPIE Fellow (SPIE-the International Society of Optics and Photonics), 2008.
- Recipient of “the 2005 SAE Excellence in Oral Presentation Award” for presentation at SAE 2005 Annual World Congress, April 11-14, 2005, Detroit, USA.
- Faculty Research Fellowship, Oakland University, 2003.
- Recipient of "the 1st prize of the Association of German Engineers in 1998” in the contest for the best PhD thesis in the field of technology/Science.

Service Activities:

<u>Selected Service within the Institution</u>

- Member of the Faculty Re-employment and Promotion Committee (FRPC) of Oakland University (09/2010 -08/2013)
- Member of Bioengineering Steering Committee (02/2007 – 10/2011)
- Member of the School Graduate Committee (2002-2005)
- Member of the Committee on Appointment and Promotions (CAP) of the School (08/2005-09/2007 and 08/2008-09/2010)
- Chair (2002 –2003) and Member (2003 – 2004) of Graduate Committee of Mechanical Engineering department
- Chairs and Members of more than 10 C1, C2 and tenure reviewing committees.
- Chairs and Members of a number of search committees

<u>Selected Service outside of the Institution</u>

- Associate Editor, “SAE International Journal of Materials and Manufacturing” (12/2013 – present).
- Editorial Board of SCI Journal "Optics and Lasers in Engineering" (09/2013 – present)
- Associate Editor of SCI Journal, “Optical Engineering” (10/2011 – present).
- Associate Editor of SCI Journal “Material Evaluation” (3/2007 – present).
- Editorial Board of “Journal of Mechanical Engineering”, A SCI Journal of Chinese Society of Mechanical Engineering (CSME) (01/2009 – present).
- Editorial Board of the International Journal “Journal of Holography and Speckle,” (09/2003 – present).
- Chair (from 04/2010 – 04/2012) and Vice Chair (from 04/2008 to 04/2010) of Material Modeling and Testing Committee of the International Society of Automotive Engineers (SAE-International)
- Co-Organizer and Co-Chair of multiple sessions: “Optical Techniques in Automotive Engineering,” SAE Annual World Congress, Detroit, MI, April of Each Year, Since 2005.

Most Important Publications and Presentations (in the past five years)
Published two book chapters, 5 editorships, 20 peer-reviewed journal and 30 conference publications, applied for 3 US patents and gave numerous of presentations & seminars in the past five years. Selected journal publications in 2013 are listed below.

- L.X. Yang, X. Xie, N. Xu, and X. Chen, Fast non-destructive testing under dynamic loading, invited paper for SPIE Newsroom, November 8, 2013.
- X. Chen, L.X. Yang (corresponding author), N. Xu, and X. Xie, B. Sia, asnd R. Xu, Cluster approach based multi-camera digital image correlation: Methodology and its application in large area high temperature measurement, Accepted by Optics & Laser Technology, in press.
- X. Xie, L.X. Yang (corresponding author), N. Xu, and X. Chen, Michelson interferometer based spatial phase shift shearography, Applied Optics, Vol. 52 (17), June 2013, p.4063 - 4071.
- F.X. Chen, X. Chen, X. Xie, X. Feng, and L.X. Yang, Full-Field 3D Measurement Using Multi-Camera Digital Image Correlation System, Optics and Lasers in Engineering, Vol. 51, 2013, p. 1044¨C1052.
- L.Q. Zhu, Y.H. Wang, N. Xu, S.J. Wu, M.L. Dong, and L.X. Yang (corresponding author), Real-time Monitoring of Phase Maps of Digital Shearography, Optical Engineering, Vol. 52 (10), 2013, 101902.
- X. Xie, N. Xu, J.F. Sun, Y.H. Wang, and L.X. Yang (corresponding author), Simultaneous Measurement of Deformation and the First Derivative with Spatial Phase-shift Digital Shearography, Optics Communications, Vol. 286, 2013, P. 277 ¨C 281.

Most Recent Professional Development Activities:

- Attend two or more conferences and seminars every year including SPIE, ASNT, SEM and SAE annual research conference.
- Regularly attend the Stamping Committee, Steel/Auto Partnership Committee monthly or bi-monthly meetings.

Name: Qian Zou

Education:

Ph.D., Mechanical Design and Theory, Tsinghua University, China, 2001
M.S., Mechanology, Tsinghua University, China, 1994
B.S., Mechanical Design and Manufacturing, Tsinghua University, China, 1992

Academic Experience:

Oakland University, Associate Professor, 08/2008-present, full time
Oakland University, Assistant Professor, 08/2002-07/2008, full time
Oakland University, Visiting Instructor, 01/2002-06/2002, full time
Tsinghua University, China, Lecturer, 09/1996-12/2001, full time
Tsinghua University, China, Assistant Professor, 09/1994-08/1996, full time

Non-academic Experience:

None

Certifications or Professional Registrations:

None

Current Membership in Professional Organizations:

ASME, STLE, SME, SAE, Sigma XI and Tau Beta Pi

Honors and Awards:

- Distinguished Associate Professor Award, SECS, Oakland University, 2012.
- New Investigator Research Excellence Award, Oakland University, 2006.
- Nominee for Oakland University Teaching Excellence Award, 2006.
- Oakland University Research Fellowship, 2003 and 2006.
- National Science Foundation fellowship to the NSF Summer Institute on Nano Mechanics and Materials, 2003.
- Achievements in Scientific Research Promotion (Third Class), Tsinghua University, 1999.
- National Award for Achievement in Technology Invention (Third Class), Chinese Ministry of Science and Technology, 1996.
- Great Achievement in Science & Technology Award (First Class), Chinese Ministry of Education, 1996.
- Friends of Tsinghua – Award for Excellent Teachers (Second Class), 1995 and 1996.
- Best Paper Award, Chinese Mechanical Engineering Society, 1995.

Service Activities:

Service within the Institution

- ME Department Undergraduate Committee, Member, 08/02 – 08/05, 08/12 – present.
- ME Department Graduate Committee, Chair, 8/2006 – 8/2007, Member, 8/2005 – 8/2006, 8/2007 – 08/2012.
- ME Faculty Candidate Search Committee, Member, 08/2006 – 07/2007, 01/2014-present.
- SECS Graduate Committee, Chair, 08/11-08/12, member, 8/06 – 8/07, 08/12- present.
- SECS Committee of Academic Standing, Member, 8/2005 – 8/2007, 08/2011 – present.
- Elected Member of SECS Committee on Appointments and Promotion (CAP), winter 2013 and 2014.
- SECS Research Committee, Fall 2012
- Oakland University Senate Academic Conduct Committee, Member, 08/2013 – present.

- Oakland University William Beaumont Institute for Stem Cell and Regenerative Medicine, member, 3/2011 – present.
- Oakland University Senate, Member, 08/2007 – 08/2009.
- Oakland University Senate Library Committee, Member, 08/2005 – 08/2007

<u>Service outside of the Institution</u>

- Session organizer of SAE World Congress, 05/2012 - present.
- Member of the editorial board of ISRN Tribology (03/2012 – present) and International Journal of Powertrains (04/2011-present); panel reviewer of Nature magazine (2010-2011); technical editor of Tribology & Lubrication Technology (2009).
- Reviewer of journals/conferences/NSF proposals.
- Session Chair of STLE Annual Meetings, SAE World Congress, International Conference on Wear of Materials, STLE/ASME International Joint Tribology Conference
- Officer of the Society of Tribologists and Lubrication Engineers – Wear Technical Committee (Secretary: 2013 – present, Vice Paper Solicitation Chair: 2011- 2012, Chair: 2007-2008, Secretary: 2006-2007, Paper Solicitation Chair, 2005 – 2006, Vice Paper Solicitation Chair: 2003 – 2005).
- Membership Chair of STLE Detroit Section, 2004 – present.

Most Important Publications and Presentations (in the past five years)

Published 15 journal and 8 conference publications, gave 37 presentations in the past five years. Selected publications are listed below.

- L. Gara, Q. Zou, "Friction and Wear Characteristics of Oil Based ZnO Nanofluids", *Tribology Transaction*, Vol. 56, No.2, pp.236-244, 2013.
- Q. Zou, C. Rao, G. C. Barber, B. Zhou, Y. Wang, "Investigation of surface characteristics and tribological behavior of clutch plate materials", *Wear*, Vol. 302, No. 1-2, pp.1378–1383, 2013.
- J. Han, Q. Zou, "Evolution of Contact Characteristics during a Scuffing Process", *Tribology Transactions*, Vol.56, No.4, p58-64, 2013.
- G. Abed, Q. Zou, G. C. Barber, B. Zhou, Y. Wang, Y. Liu, F. Shi, "Study of the Motion of Floating Piston Pin against Pin Bore", *SAE Int. J. Engines*, 6(2), 2013.
- L. Gara, Q. Zou, "Friction and Wear Characteristics of Water-Based ZnO and Al2O3 Nanofluids", *Tribology Transactions*, Vol.55, No.3, pp.345-350, 2012.
- J. Han, Q. Zou, G. C. Barber, T. Nasir, D. O. Northwood, X. C. Sun, P. Seaton, "Study of the Effects of Austempering Temperature and Time on Scuffing Behavior of Austempered Ni–Mo–Cu Ductile Iron", *Wear*, 290-291, pp. 99-105, 2012.
- E. A. Liu, Q. Zou, "Machined surface error analysis - a face milling approach", *Journal of Advanced Manufacturing Systems*, Vol. 10, No.2, pp. 293-307, 2011.
- L. Gara, Q. Zou, B. P. Sangeorzan, G. C. Barber, H. E. McCormick, M. H. Mekari, "Wear Measurement of the Cylinder Liner of a Single Cylinder Diesel Engine Using a Replication Method", *Wear*, Vol.268, No.3-4, pp. 558-564, 2010.

Most Recent Professional Development Activities:

- Attend two or more conferences and seminars every year including STLE Annual Meetings, ASME/STLE International Joint Tribology Conference, SAE World Congress, STLE Detroit section education seminars and technical meetings.
- Regularly attend the seminars hosted by the Center for Excellent Teaching and Learning.

Appendix C – Equipment

Major Instructional Equipment Existing Prior to Fall 2014:

TABLE C-1: EXISTING LABORATORY EQUIPMENT
Statics and Dynamics Instruction: Ramp and sliding block friction set**,** Square frame with truss system, Assembly for Pulley System Analysis**,** Projectile Device, Impact Pendulum, Vibration Test Structure
Materials Properties Instruction: Two Tension Test Machines, One Fatigue Test Machine, Impact Tester**,** Hardness Tester
Mechanics of Materials Instruction: Thin wall pressure Vessel with strain gauge, Torsion bar with strain gauge, simply supported beam with strain gauge
Fluid Mechanics Instruction: Wind tunnel, Piped fluid flow with friction apparatus, Refrigeration lab system, Jet thrust apparatus, Venturi Flow Meter Apparatus**,** Viscometer, Data Acquisition Device (2), Fluid Measurement and Supply Units
Heat Transfer Instruction: Heat exchanger lab system, Convection/Radiation lab apparatus**,** PC Heat Exchange Apparatus (2), Thermal Conductivity Measurement Equipment
Thermodynamics Instruction: R-13ha Properties Measurement Apparatus, Refrigeration apparatus, Bomb Calorimeter (2)
Tribology Student Research: Pin-on-Disk Wear Tester**,** Reciprocating Wear Tester**,** Surface Tracer**,** Wyko 3-dimensional Surface Tracer
Fastening and Joining Student Research : DC Nut-Runner**,** Ultrasonic Device for Monitoring Bolt Tension (2)**,** Vibratory Bolt Loosening Machine
Metal Forming Student Research: V-bend die with Press, Hydroforming Die Set, Limiting Dome Height Press, Draw Bead Simulator Machine, Circle Grid Application System, 12 inch Shearing Machine, Rectangular Channel Die Set, Screw Press
Optical Techniques Student Research: Digital Image Correlation System**,** High Speed Optical Measurement System**,** Holography Measurement System**,** Three Dimensional Computer Vision System**,** Electronic Speckle Pattern Interferometry**,** Shearography System**,** Optical Device for Residual Stress Measurement
Polymers Science Student Research: Polymer Extruder**,** Injection Molder **,** Melt Flow Index Device**,** Compression Molding Device, Rapid Prototyping Machine
Major Machine Shop Tools: Polishing Wheels**,** Belt Sander**,** Mounting Press**,** Furnace (2)**,** Cut-off Wheel**,** NC Milling Machine**,** NC Lathe, Band Saw
PC's or Monitors with Server: Approximately 220 units dispersed throughout Dodge Hall, Hannah Hall and the off-campus site of the University Center. Also see Computing Facilities, section 7.B

Major Instructional Equipment Added for Fall 2014

Table C-2: New Laboratory Equipment in the New Engineering Center
Statics and Dynamics Instruction: Stress/Strain(10); Force Accessory Bracket(10); Chaos Driven Harmonics(10); Conversion of Angular Momentum(10); Rotary Motion Sensor(10); Energy Transfer-friction(4); Heat Tube(4); Chaos(4); Conservation of Momentum(4); Impulse(4); Archimedes Balance(4); Stress Strain(10); Conservation of Energy(10); Rotational Inertia Set(10); Conservation of Angular Momentum(10); Harmonic Oscillator(4); Conservation of Energy 2(10); Stupwabol Pack(1); Torsion Pendulum Set(10); Short Range Launcher(10); Ballistic Pendulum; Bicycle Wheel Gyroscope(2); Truss Set(10); Adv. Structure Set(10); Bridge Set(10);Willber Force Pendulum(10); Complete Rotational System(10); 3 axis gyroscope(10); Intro Rotational Apparatus(10); Base and Support Rod(10); 1.2 m classic dynamics system(4); 2.2 m Class Dynamic Systems(4); Collision cart(10); Super Dynamics System(4); Photogate Head(10); Photogate Bracket(10); Friction block(10); Roller Coaster system(10); Centripetal Force Pendulum(10); Matter Model(10); Hooke's Lawset; Physical Pendulum set(10); Hovercraft(10); Flexible – beam(10); Passport interface(10); Motion sensor(10); Rotary Motion Sensor(4); Load Cell/Amplifier Set; Pulley Demo System(10); Force(45); Digital Caliper(10); Balance Scale(10); Hooked Mass Set(10); Cordless Air Source(10); Wave Motion Demonstrator(4); DC Power Supply; Mechanical Wave Generator(8); Economy Wave Generator(4); String Vibrator(4); Sine Wave Generator(4); Wave Drive Post(4) Ripple Tank System(4).
Materials Properties Instruction: Atmosphere Controlled or Vacuum Box Furnace with Retort(2); Mechanical Test System; Beam Fatigue Tester; Impact Tester; Microhardness Tester; Stereomicroscope with Digital Capture;
Fluids Instruction: Venturi Apparatus(4); Quad Pressure Sensor(4);Spirometer Sensor(2); Hydraulic/pneumatic system(2); Pressure Calibration Unit; Hydraulic Bench; Fluid Friction Unit; Dead Weight Tester; Impact of a Jet(2); Hydrogen Bubble Flow Visualization System; Centrifugal Compressor Demonstration Unit; Centrifugal Pump Demonstration Unit; Radial Flow Turbines Unit; Turbine Service Unit; Interface Unit; Computer Controlled Wind Tunnel; Incline Manometer Bank; Electric Manometer Bank; Life and Drag Balance; Pitostatic Tube; Wake Survey Rake; Lift and Drag Air Foil; Pressure Wing; Drag Models; Pressure Cylinder; Bernoulli Apparatus; Boundary Layer Plate.
Heat Transfer Instruction: Heat Conduction(4); Conductivity Apparatus(4);Cavity Radiation(4); Black Body Radiation(4); Temperature Calibration Unit; Heat Transfer Service; Linear Heat Conduction(2); Extended Surface Heater(2); Unsteady Heat Transfer; Thermoelectric Heat Pump.
Thermodynamics Instruction: Mystery Density Set; Discovery Density Set; Overflow can; Classroom Density set; Energy Transfer-thermoelectric(4); Absolute Zero Apparatus(4);Idea Gas Law(4); Heat Energy Efficiency(4); Small Piston Heat Engine(4); Sterling Engine(4);Low Delta-T Sterling Engine(4); Adiabatic gas Law(4); Steam Generator(4); Compact Thermal Expansion(4); Energy Transfer

Table C-2: New Laboratory Equipment in the New Engineering Center
Calorimeter(4);Specific Heat(4); Atomic Spectra(4); Vapor Compression Ref. Unit; Air Condition Unit; Thermal Radiation Lab(4); Thermal Expansion(4).
Tribology Student Research: Lab Refrigerator; Ultrasonic Cleaning Bath; Spectrometer(FTIR); Surface Tracer.
Major Machine Shop Tools: Water jet; Laser; 3D printer(2); Cold Saw; Horizontal Band Saw; 20'' Disc Sander; Box and Pan Brake; Pipe and Tube Bender; Tube Notcher; Panel Saw; Welder; Welding Curtain; Vertical Band Saw; CNC Enclosed Milling Center; S axis Machining Center; 3-1 Material; Table Saw; Drill Press; Safety Clean Station; Surface Grinder; Radial Drill; Hi-Low and Comb Sander.
Microscopy Student Research: XPS Microprobe; SEM-Scanning Electron Microscope
SAE Office: PBC Plotter; PCB Reflow Oven; TIG Welder; Media Blaster; Exhaust Tube; Parts Washer; CAD-Cable PC(2); Printer/Plotter; Engine Dynamometer; PC Data Acquisition System; Cylinder Pressure Transducer and Amps; Car Lift; Chassis Dynamometer; CNC Mill; MIG Welder; Surface Grinder.
Senior Design Lab: HP Computer with Monitor(14); Power Supply(14); Digital O-scope(14); Digital Multi-meter(14); Function Generator(14).
Sophomore Project Lab: HP Computer with Monitor(10); Power Supply(10); Digital O-scope(10); Digital Multi-meter(10); Function Generator(10); Printer(1).
Energy Lab: Rankine Cycle Lab; Turbo Gen Electrical Generation System; IC Engine lab unit and Indicator Set.
CAD/CATIA ME: Quad Core Computers(46); Printer(1)

Appendix D – Institutional Summary

1. *The Institution*

a. **University address:**

Oakland University
2200 N. Squirrel Road
Rochester, MI 48309-4401

b. **University's Chief Executive Officer:** Betty J. Youngblood, Interim President

c. **Person submitting Self-Study Report:** Louay Chamra, Dean and Professor

d. **Institutional accreditation:** Higher Learning Commission of the North Central Association, initial accreditation 1966, most recent accreditation 2013.

2. *Type of Control*

Oakland University is a state university.

3. *Educational Unit*

The Bachelor of Science in Engineering with a major in Mechanical Engineering program is located in the Mechanical Engineering (ME) Department. The individual responsible for the B.S.E. in with a major in ME program is the Chair of the ME Department, Zissimos Mourelatos, Ph.D.

The ME Department is located in the School of Engineering and Computer Science (SECS) which is led by the SECS Dean, Louay Chamra. The ME Department Chair reports directly to the SECS Dean.

Oakland University's organizational chart, from the SECS Dean to the university's President, is shown in Figure D-1. The organizational chart for the SECS is shown in Figure D-2.

4. *Academic Support Units*

Mathematics and Statistics Dept., Laszlo Liptak, Chair
Physics Dept., Andrei Slavin, Chair
Chemistry Dept., Arthur Bull, Chair
Economics Dept., Anandi Sahu, Chair
Philosophy Dept., Mark Rigstad, Chair
Writing and Rhetoric Dept., Marshall Kitchens, Chair

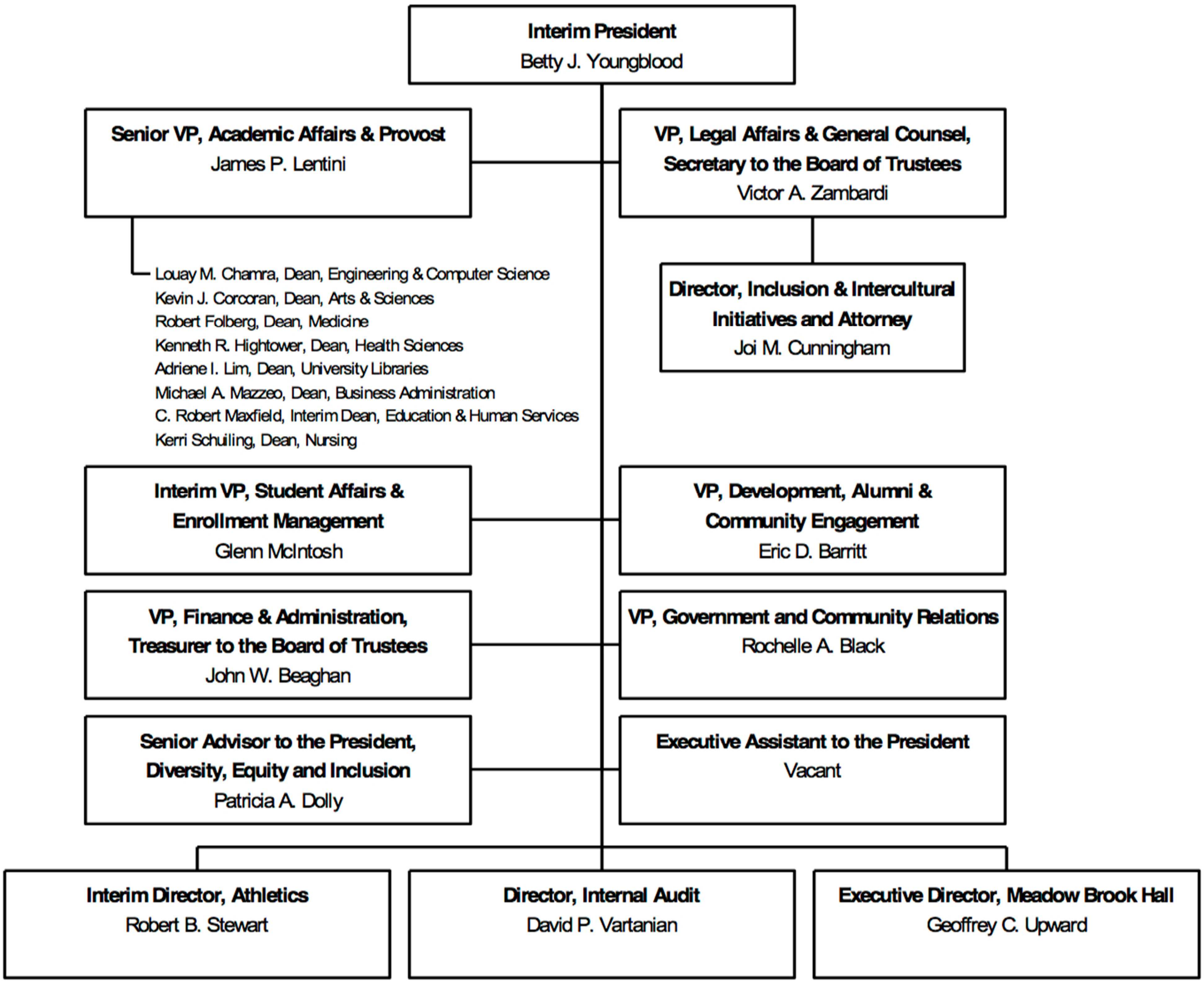

Figure D-1. Oakland University Organizational Chart

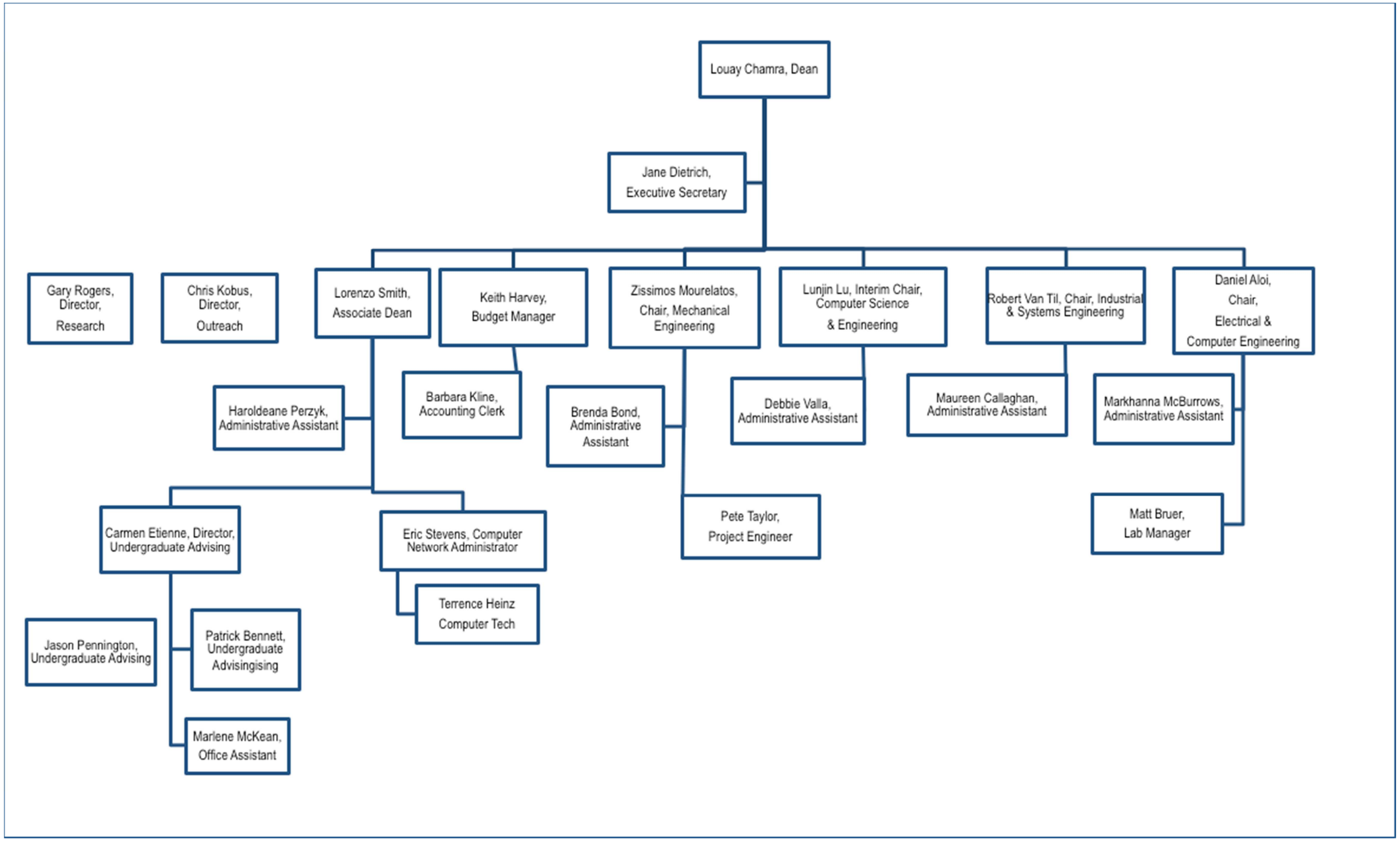

Figure D-2 Organizational Chart for the SECS

5. Non-academic Support Units

Kresge Library, Nancy Bulgarelli, Interim Dean
University Technology Services, Theresa Rowe, Chief Information Officer
Undergraduate Admissions, Eleanor Reynolds, Assistand Vice President for Student Affairs and Director of Admissions
Career Services, Wayne Thibodeau, Director
Registrar's Office, Steve Shablin, Registrar
Tutoring Center, Beth DeVerna, Director
Financial Aid Office, Cindy Hermsen, Director

6. Credit Unit

The Oakland University 2014-15 Undergraduate Catalog defines a *credit hour* as follows.

> *For purposes of awarding academic credit for courses and programs at Oakland University, a credit hour shall be consistent with federal guidelines and is an amount of work represented in intended learning outcomes and verified by evidence of student achievement. The OU-established equivalency reasonably approximates and is not less than:*
>
> 1. *One credit hour consists of 50 minutes of classroom or direct faculty instruction (synchronous or asynchronous) and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester hour of credit; or*
> 2. *At least an equivalent amount of work as required in #1 above of this definition for other academic activities as established by the institution including laboratory work, internships, practica, field work, clinical work, studio work, and other academic work leading to the award of credit hours.*
>
> Regardless of their duration, courses contain the same total number of credit hours as if they were scheduled for at least a 15-week semester.

7. Tables

Table D-1. Program Enrollment and Degree Data

Mechanical Engineering

	Academic Year		Enrollment Year					Total Undergrad	Total Grad	Degrees Awarded			
			1st	2nd	3rd	4th	5th			Associates	Bachelors	Masters	Doctorates
Current Year	2013	FT	103	55	60	75	6	299	81	0	52	27	4
		PT	10	8	21	32	6	77	87				
1	2012	FT	67	34	49	69	3	222	69	0	29	31	5
		PT	8	8	17	33	2	68	73				
2	2011	FT	50	25	48	40	0	163	59	0	49	31	5
		PT	3	12	23	31	3	72	65				
3	2010	FT	34	32	40	50	2	158	58	0	53	36	3
		PT	6	4	19	23	6	58	62				
4	2009	FT	40	29	34	70	2	175	58	0	55	55	8
		PT	5	5	23	26	3	62	67				

FT--full time
PT--part time

Table D-2. Personnel

Mechanical Engineering

Year: 2013-14 (Fall 2013)

	HEAD COUNT		FTE[2]
	FT	PT	
Administrative	1[1]		1.0
Faculty (tenure-track)	15		15.0
Other Faculty (excluding student Assistants)		4	0.8
Student Teaching Assistants	10	1	10.5
Technicians/Specialists	5[2]	4	2.1
Office/Clerical Employees	1		1.0
Others			

Footnotes:

1. *Chairperson with half time release from teaching. Oakland University considers a chairperson equivalent to a full-time faculty.*

2. *Includes a Technician for mechanical equipment and instrumentation, a Computer Technologist, a Network Administrator, a Laboratory Manager and an Assistant Lab Manager who look after electrical/electronics equipment for the School.*

Appendix E – Exhibits

E.1 Plan of Study Form
E.2 Graduation Review form
E.3 Online Alumni Survey Form
E.4 External Evaluation Form
E.5 Online Student End-of-Course Evaluation Form
E.6 Online End-of-Course Summary Form
E.7 Peer Evaluation form for Senior Design
E.8 Online Senior Exit Questionnaire Form
E.9 Online Employer Survey Form

Exhibit E.1: Plan of Study Form

School of Engineering and Computer Science
Office of Undergraduate Advising: 255 Engineering Center

B.S.E. Mechanical Engineering
2014-2015
Catalog

Student Last Name	Student First Name	Student #:	Date:	Catalog: Select	Entered OU: Select

GENERAL EDUCATION REQUIREMENT - requires one course of 4 credits in each area for a minimum of 28 credits. See catalog for a list of GE courses.

	OU Course	Cr.	Grd.	Transfer	Sem.	Rpt.
Arts (4)						
Foreign Language and Culture (4)						
Literature (4)						
Western Civilization (4) - ***PHL104 required***	PHL104					
Social Science (4) - ***Economics required***	ECN150, 201 or 202					
Global Perspectives (4)						
Writing Foundations: Comp II (4)	WRT 160					
General Education Total Credits:						

GENERAL EDUCATION THAT MAY BE DOUBLE-COUNTED - Courses that may be used to satisfy other degree requirements

	OU Course	Grade	Transfer	Sem.	Rpt.
U.S. Diversity					
Writing Intensive in General Education					

MATH/SCIENCE REQUIREMENT - requires courses in math and science for a minimum of 32 credits. *Denotes requirement for major standing.

	OU Course	Cr.	Grd.	Tran.	Sem.	Rpt.
MTH154: Calculus I (4)*						
MTH155: Calculus II (4)*						
MTH254: Multivariable Calculus (4)						
APM255: Intro to DiffEQ w. Matrix Alg. (4)*						
PHY161: Fundamentals of Physics I (4)*						
PHY162: Fundamentals of Physics II (4)*						
CHM143: Chemical Principles (4)*						
Approved Math/Science Elective (4)						
Math/Science Total Credits:						

ENGINEERING CORE REQUIREMENT - requires one course in each area of the following areas for a minimum of 21 credits.*Denotes requirement for major standing

	Cr.	Grd.	Transfer	Sem.	Rpt.
EGR120: Engineering Graphics and Design (1)*					
EGR141: Computer Problem Solving in Engineering and CS (4)*					
EGR240: Intro to Electrical and Computer Engineering (4)*					
EGR250: Intro to Thermal Engineering (4)*					
EGR260: Intro to Industrial and Systems Eng. (4)*					
EGR280: Design and Analysis of Electromech. Systems (4)*					
Engineering Core Total Credits:					

PROFESSIONAL SUBJECTS REQUIREMENT - requires one course in each of the following areas for a total of 35 credits.

	Cr.	Grd.	Transfer	Sem.	Rpt.
ME 308: Computer-Aided Design (3)					
ME 322: Engineering Mechanics (4)					
ME 331: Intro to Fluid and Thermal Energy Transport (4)					
ME 361: Mechanics of Materials (4)					
ME 372: Properties of Materials (4)					
ME 421: Vibrations and Controls (4)					
ME 486: Mechanical Systems Design (4)					
ME 456: Energy Sys. Design **or ME 482:** Fluid/Therm. Sys. Design (4)					
ME 492: Senior Design **or ME 490**: Senior Project (4)					
Professional Subjects Total Credits:					

PROFESSIONAL ELECTIVES REQUIREMENT - requires three courses of 4 credits for a minimum of 12 credits. All professional electives must be ME designated at 400- or 500-level.

OU Course	Cr.	Grd.	Transfer	Sem.	Rpt.
Professional Electives Total Credits:					

Important Notes:

Students must be approved for **major standing** before taking any 300- or 400-level engineering or computer science course.

Students are eligible for major standing after **successful completion** of all courses denoted with an asterisk*.

Successful completion = minimum 2.0 GPA in Math/Science Requirement and minimum 2.0 GPA in Engineering Core Requirement + no more than two (2) classes in each area may be below 2.0.

Minimum 2.0 GPA in Professional Subjects Requirement + no more than two (2) classes may be below 2.0 for **graduation**.

Students may only repeat three (3) different courses in each of the Math/Science and Engineering Core areas, and two (2) in the Professional Subject area.

Advisor Notes

FREE ELECTIVES - Courses taken in addition to degree requirements.

OU Course	Credits	Grd.	Transfer	Semester

This worksheet is for advising purposes only and is not meant to be an official audit of record. Students are responsible for verifying major requirements and for reading the undergraduate catalog for all requirements necessary for degree completion at Oakland University.

Reset Form

updated 2/24/14

Exhibit E.2: Graduation Review Form

School of Engineering and Computer Science - Undergraduate Advising Office
159 Dodge Hall of Engineering - Rochester, Michigan 48309-4478
Phone: (248) 370-2201 Fax: (248) 370-2084

PRELIMINARY GRADUATION REVIEW

PLEASE SUBMIT THE SEMESTER **PRIOR TO** THE ONE IN WHICH YOU INTEND TO GRADUATE.

PLEASE SUBMIT TO UNDERGRADUATE ADVISING OFFICE (159 Dodge Hall)

SEMESTER OF GRADUATION ______________________ CATALOG USED _________

NAME ________________________________ GRIZZLY ID: G00: _______________

ADDRESS ____

CITY ______________________________________ STATE ______ ZIP ___________

OU E-MAIL ADDRESS ____

DAY TIME PHONE NUMBER ____

MAJOR __________________ OPTION / MINOR / SPECIALIZATION ________________

COURSES IN PROGRESS	SEMESTER	COURSES TO BE TAKEN	SEMESTER
__________________	__________	____________________	________
__________________	__________	____________________	________
__________________	__________	____________________	________
__________________	__________	____________________	________

HAVE YOU:

FILED FOR DEGREE ON-LINE (Must submit Application for Degree on-line by published deadline.)	YES	NO
REGISTERED IN CAREER SERVICES OFFICE	YES	NO
COMPLETED ON-LINE GRADUATION EXIT SURVEYS	YES	NO

STUDENT SIGNATURE ___________________________________ DATE ___________

FOR USE BY UNDERGRADUATE ADVISING OFFICE:

APPROVED ________ CONDITIONALLY APPROVED _______ DENIED ________

____

____

____

AUTHORIZED SIGNATURE ______________________________ DATE _____________
(PATRICK C. BENNETT and/or CARMEN ETIENNE: ACADEMIC ADVISERS)

CC: STUDENT STUDENT FILE MAILED: ____________________ (9/2012)

Exhibit E.3: Alumni Survey Form

OU ME Alumni Survey

Alumni Survey Questionnaire
Oakland University
Mechanical Engineering Department

Dear Alumni,
This Alumni Survey is an important assessment tool by which we evaluate the effectiveness of our program of study. Any future planning must draw from past experiences, and the success of our department can be measured by the achievements of our alumni. This survey is also an important part of the self-study that we conduct to learn of your progress and to provide documentation for the continued accreditation of our programs by professional accreditation agencies. Please take a moment of your time to complete this questionnaire. Your responses will be treated in strict confidence and used only in statistical analyses. Thank you for your time in helping us to continuously improve our program.
Thank you,

Zissimos Mourelatos
Professor and Chair, Mechanical Engineering Department

This survey is anonymous. Please answer every question to the best of your ability.

---

1. **Degree obtained from Oakland University:**
   Check all that apply.
   - [ ] BS in Mechanical Engineering
   - [ ] Other: ____________________
2. **Graduation Year (latest date if double major):**

   ____
3. **Current Geographic Location (State, Country):**

   ____
4. **Are you or have you been employed in an engineering or engineering-related field?**
   Check all that apply.
   - [ ] Yes
   - [ ] No

5. **Current Business Sector:**
Mark only one oval.

- ◯ automotive
- ◯ defense
- ◯ manufacturing
- ◯ energy
- ◯ government
- ◯ health care
- ◯ education
- ◯ education
- ◯ service industry
- ◯ finance
- ◯ law
- ◯ construction
- ◯ agriculture
- ◯ other

6. **Your Gender:**
Check all that apply.

- ☐ Male
- ☐ Female

7. **Were You Active in Student Organizations? If so, which organization(s)?**

____

Program Educational Outcomes (PEO's)

8. **1. How well do you feel the program prepared you to analyze, design, develop and/or test components or systems in the areas of mechanics and/or fluid and thermal sciences?**
Check all that apply.

- ☐ Excellent
- ☐ Very Good
- ☐ Good
- ☐ Adequate
- ☐ Poor

9. **2. How well do you feel the program prepared you to use laboratory (instrumentation, testing, prototyping, etc) and/or computer skills for engineering analysis and design?**
Check all that apply.

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Adequate
- [ ] Poor

10. **3. How well do you feel the program prepared you to adapt and contribute to new technologies and methods, and use these in engineering applications?**
Check all that apply.

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Adequate
- [ ] Poor

11. **4. How well do you feel the program prepared you to pursue graduate studies in mechanical engineering or related disciplines?**
Check all that apply.

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Adequate
- [ ] Poor

12. **4a. If you have or intend to pursue graduate studies, please indicate the field and degree**
(e.g., M.S. Mechanical Engineering, Law, Medicine, MBA, etc.)

____

13. **4b. Have you participated in industry-sponsored workshops, training, certificates or other continuing education seminars?**
If 'Yes', please give a short description.

____
____
____
____
____

14. **4c. Have you obtained a Professional Engineering License?**
Check all that apply.

- [ ] Yes
- [ ] No

PEO's Continued

15. **5. How well were you prepared to function successfully in local, national or global technology-driven industries**
Check all that apply.

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Adequate
- [ ] Poor

16. **6. How well were you prepared to serve in a variety of roles and to function effectively in multidisciplinary teams, involving problems with technical and non-technical elements?**
Check all that apply.

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Adequate
- [ ] Poor

17. **7 How well do you feel the program prepared you to communicate in both written and verbal forms?**
Check all that apply.

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Adequate
- [ ] Poor

18. **7a. Have you made any technical presentations or authored any technical publications?**
If so, please describe how many and what type.

19. **8. How well do you feel that the program prepared you to function with high standards of professional integrity and ethical responsibility?**
Check all that apply.

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Adequate
- [ ] Poor

General Questions

20. **Have you used your professional expertise to provide service to the engineering profession and/or to the public?**
If 'Yes', please describe.

____
____
____
____
____

21. **Do you feel that any of the above Program Educational Outcomes should be changed?**
If 'Yes', please suggest changes. For example, "Eliminate the outcome on xxx", or suggest and outcome.

____
____
____
____
____

22. **Please add any overall comments about the ME program or your experience at OU.**
What do feel the program strengths might be? What do feel any weaknesses might be?

____
____
____
____
____

This survey is anonymous, but we could appreciate your name and address to help track participation. Your answers WILL NOT be linked to your name or email address.

23. **First Name:**

____

24. **Last Name:**

____

25. **Email Address:**

____

Exhibit E.4: Sample External Evaluation Form

SECS External Evaluation of Student Outcomes - Undergraduate

ME 492 Senior Mechanical Engineering Design Project
Winter 2014
Please examine all student work for this assignment before filling out *one form per evaluator per assignment*.

Evaluator: ____________________________________ Date: _____________

Please rate how well the student work presented *demonstrates the following student outcomes*, using a scale from 1-5. Ratings of 4 or 5 are considered acceptable levels of demonstration. Note that you are NOT grading the student work, you are indicating the level at which evidence exists that the outcome has been demonstrated. Use the comments to provide feedback or suggestions on the appropriateness of the assignment. Comments are required for ratings 1-3.

(a) An ability to apply knowledge of mathematics, science, and engineering. Comments:	1 2 3 | 4 5
(b) An ability to design and conduct experiments, as well as to analyze and interpret data. Comments:	1 2 3 | 4 5
(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. Comments:	1 2 3 | 4 5
(d) An ability to function on multi-disciplinary teams. Comments:	1 2 3 | 4 5
(e) An ability to identify, formulate, and solve engineering problems. Comments:	1 2 3 | 4 5
(f) An understanding of professional and ethical responsibility. Comments:	1 2 3 | 4 5
(g) An ability to communicate effectively. Comments:	1 2 3 | 4 5
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. Comments:	1 2 3 | 4 5
(i) A recognition of the need for, and an ability to engage in life-long learning. Comments:	1 2 3 | 4 5
(j) A knowledge of contemporary issues.	1 2 3 | 4 5

Comments:	
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Comments:	1 2 3 | 4 5

Evaluators:

Thank you for volunteering to assess the engineering programs of the SECS. This service helps us continuously improve our programs of study in order to better serve our students.

You will be examining student work which has been selected by the instructor because (s)he believes that it demonstrates one or more of the outcomes of the program of study. Your task is to rate how well the student work that you are examining *demonstrates the student outcomes*. As a guide to assigning ratings, a 4 or 5 is considered to be an acceptable level of demonstration. Use the comment section to provide feedback on the appropriateness of the assignment itself.

It is important to understand that *you are not grading the student work*. The students will receive, or have already received, their grades from their instructor.

Department Curriculum Committee Chairs:

Please compute the averages of all of the rating sheets for all evaluators, and enter them in the online External Evaluation of Student Outcomes database. You must keep the original evaluation sheets, and the student work that has been evaluated, for a period of three years.

Score	Rating	Description
5	Excellent	The assignment clearly requires the demonstration of the program outcome, and all of the student work examined demonstrates the outcome.
4	Good	The assignment provides the students the opportunity to demonstrate the outcome, and most of the student work demonstrates the outcome.
3	Improvement necessary	The assignment as written does not clearly require the student to demonstrate the outcome, or a portion of the student work does not clearly demonstrate the outcome. Comments are required.
2	Below Average	The assignment does not require the student to demonstrate the outcome, or a significant portion of the student work does not demonstrate the outcome. Comments are required.
1	Poor	The assignment has no relationship to the outcome, or no student work shows evidence of the outcome. Comments are required.

Exhibit E.5: Sample Student Online End-Of-Course Evaluation Form

Oakland University SECS Course Evaluations Manager		
Module : courses	**User : Brian Sangeorzan**	**Date : 6/26/2014 - 11:55 PM**
[Home] [Courses] [Misc. Functions] [Objectives] [Wrap-up Meetings] [Logout]		

10159 : ME 492
Sr Mechanical Egr Design Proj
Winter Semester 2014
Michael Latcha

Welcome to the SECS course evaluation survey.

No.	Question	Excellent	Good	Average	Poor	Unsatisfactory	NA
1.	The instructor did a good job of making the objectives of the course clear to me.	○	○	○	○	○	○
2.	The instructor did a good job in developing and presenting the material in a clear and organized manner.	○	○	○	○	○	○
3.	The instructor stimulated and deepened my interest in the subject.	○	○	○	○	○	○
4.	The instructor motivated me to do my best work.	○	○	○	○	○	○
5.	Explaining and clarifying difficult	○	○	○	○	○	○

	material and problem solutions						
6.	Willingness to provide individual assistance to students outside of classroom hours	○	○	○	○	○	○
7.	Ability to handle questions from the class.	○	○	○	○	○	○
8.	Utilization of class time	○	○	○	○	○	○
9.	Utilization of instructional aids such as blackboard, slides or viewgraph	○	○	○	○	○	○
10.	Uniformity and impartiality in grading	○	○	○	○	○	○
11.	Promptness in returning homework, laboratory reports and examinations.	○	○	○	○	○	○
12.	Overall rating as a teacher.	○	○	○	○	○	○
13.	Value of the textbook contribution to the course.	○	○	○	○	○	○
14.	Value of the recitation component of the course.	○	○	○	○	○	○
15.	Value of the laboratory component of the course.	○	○	○	○	○	○

16.	Please rate the adequacy of the computing and/or laboratory facilities.						
17.	Please provide an overall rating of this course as a learning experience.						

18. What is your approximate cumulative grade point average?

19. Provide how many study hours you spent per week outside of the classroom for this course.

20. What grade do you expect to receive in this course?

21. What is your assessment of the amount of material covered in the course?

22. Please provide additional comments regarding the instructor

23. Please provide additional comments regarding the course

24. Please provide additional comments regarding grading and evaluation
25. Please provide additional comments regarding anything else

Course Objectives

Please rate on a scale of 5-0 how well the course taught you to meet each of the following objectives.

Objective	5 Excellent	4 Good	3 Average	2 Poor	1 Unsatisfactory	0 NA
Demonstrate an ability to apply knowledge of mathematics, science, and engineering	○	○	○	○	○	○
Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret	○	○	○	○	○	○

data						
Demonstrate 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	○	○	○	○	○	○
Demonstrate an ability to function on multi-disciplinary teams	○	○	○	○	○	○
Demonstrate an ability to identify, formulate, and solve engineering problems	○	○	○	○	○	○
Demonstrate an understanding of professional and ethical responsibility	○	○	○	○	○	○
Demonstrate an ability to communicate effectively	○	○	○	○	○	○
Demonstrate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	○	○	○	○	○	○
Demonstrate a recognition of the need for, and an ability to engage in life-long	○	○	○	○	○	○

learning						
Demonstrate a knowledge of contemporary issues	○	○	○	○	○	○
Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	○	○	○	○	○	○

Comments? Questions? Contact the **[administrator]**

Exhibit E.6: Sample Faculty End-Of-Course Summary

Oakland University SECS Course Evaluations Manager		
Module : courses	**User : Osamah Rawashdeh**	**Date : 6/17/2014 - 3:13 PM**
[Home] [Courses] [Misc. Functions] [Logout]		

Course Information

40874: EGR 280 Dsgn/Anyl of Electromech Sys
Instructor : Osamah Rawashdeh and Dave Schall
Course Dates : 9/3/2013 12/14/2013
Evaluation Window : 11/28/2013 12/7/2013
Course Text: L earning by Example Using C - Programming the DRAGON12-Plus Using CodeWarrior by Richard E. Haskell and Darrin M. Hanna.
General Comments:

Course Objectives - Comments and Change / Delete Requests

Objective	Comment	Action
1. Write C programs to interface a microcontroller to external devices and to download the program to flash memory in a microcontroller using modern development tools. Median: 5 Std. Dev: 0.9 Avg. Grade: 4.3		
2. Solve statics problems involving particles and rigid bodies. Median: 4 Std. Dev: 0.9 Avg. Grade: 3.9	There are a number of problems with the mechanics portion of EGR 280. Let's start with those that can be addressed in the current course format. Students' primary complaints with both ME learning objectives were lack of a textbook and slow feedback on labs and exams. The students also requested that lecture notes be made available. In previous semesters the lecture notes were saved electronically at the end of each lecture and distributed to the students via Moodle. In discussions with other faculty is was suggested that I try withholding the in-class lecture notes to encourage better note taking and attention in class. I failed to recognize that without a textbook students were at a significant disadvantage because they had no good reference to go back to if they missed	

	something from the notes.. (Despite the fact that a significant number of online / free mechanics textbooks exist and are readily available on the web!) To fix the text book issue, both class notes and an electronic free online text will be selected for students to use. At present I will likely use http://www.ecourses.ou.edu/ This resource also makes use of online prerecorded lectures. The current plan is to try to flip the class room and assign lectures for the students to view outside of class and spend the majority of the class time working and solving problems. NOTE: Traditionally no textbook has been required for EGR 280 because of the associated cost and the fact that there is no consistency in textbooks in the follow on course ME 322. The second issue was in regards to grading. The ME department chair only assigned ½ TA to this course of approximately 80 students. This TA had to attend 5 labs per week (4 at OU and 1 at Macomb) plus proctor the class at Macomb in addition to any grading of assignments. Because of the lack of manpower, no homework assignments were collected (who could grade them) and all exams were graded by the instructor. This meant long lag times between the time exams were taken to the time students received feedback on their work. This was embarrassing to the instructor and frankly unacceptable. Upon discussion with the ME chair 2 ½ TAs will be assigned to the course in coming semester to more evenly divide the work load. In addition I am looking into ways to decrease the time required to give feedback by finding some online assignment tools to use for this class. None of these "fixes" will change the fact that this course is pedagogically flawed. Research shows that students to be most successful need "soak time" and spacing. Trying to cram both statics and dynamics into a 6 week time frame is a fools errand. See the following references: • Vlach, HA, and CM Sandhofer. "Distributing learning over time: the spacing effect in children's acquisition and generalization of science concepts." Child Development 83, 4 (2012): 1137-44. • Rohrer, D, et al. "Interleaved practice improves mathematics learning." submitted (2013). • Rohrer, D, and H Pashler. "Recent research on human learning challenges conventional instructional strategies." Educational Researcher 39, 5 (2010): 406-412. • Rohrer, D, and H Pashler.	

	"Increasing retention without increasing study time." Current Directions in Psychological Science 16, 4 (2007): 183-186. • Carpenter, SK, et al. "Using spacing to enhance diverse forms of learning: Review of recent research and implications for instruction." Educational Psychology Review 24, 3 (2012): 369-378. • Rawson, KA, and J Dunlosky. "Optimizing schedules of retrieval practice for durable and efficient learning: How much is enough?" Journal of Experimental Psychology: General 140, 3 (2011): 283. • Rohrer, D, and H Pashler. "Increasing retention without increasing study time." Current Directions in Psychological Science 16, 4 (2007): 183-186.	
3. Solve kinematic and kinetic dynamics problems involving particles and rigid bodies using Newton's Second Law, Work and Energy, and Impulse and Momentum principles. Median: 4 Std. Dev: 1.1 Avg. Grade: 3.7	See comments on statics above. Change to: Solve kinematic and kinetic dynamics problems involving particles using Newton's Second Law, Work and Energy, and Impulse and Momentum principles. Rational: It is difficult to cover all the required background materials and statics and particle dynamics much less add rigid body motion. Other recommendations: There seems to be a significant gap in abilities in students coming into this course. Part of this gap might be addressed with better and more immediate feedback. But part of the problem lies with the pedagogical issues described above. To help space things out it is recommended that the course needs to be separated into three 2 credit classes. Micro-controlers and Intro to Statics and Dynamics for ME majors and ME non-majors.	CHANGE TO: Solve kinematic and kinetic dynamics problems involving particles using Newton's Second Law, Work and Energy, and Impulse and Momentum principles.
4. Explain and illustrate the basic concepts of engineering ethics and apply them in practice. Median: 4 Std. Dev: 1.1 Avg. Grade: 3.7	The score for this objective seems to vary around 4.0 from semester to semester. One variable is the speaker we get to give the guest lecture. With the addition of a new GenEd course (PHL104), the coverage of ethics in EGR280 should be reexamined. There is simply not enough time to cover it adequately.	
5. Work constructively in a multidisciplinary team to design, analyze and present an electromechanical system, subject to specific constraints. Median: 4 Std. Dev: 0.8 Avg. Grade: 4.2		

Program Outcomes

1. Applies to: ALL
Outcome: a) An ability to apply knowledge of mathematics, science, and engineering
Status: Introduced
Labs and Final Project

2. Applies to: ALL
Outcome: b) An ability to design and conduct experiments, as well as to analyze and interpret data
Status: Introduced
Lab 6 and 7

3. Applies to: ALL
Outcome: 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.
Status: Introduced
Final Project Reports.

4. Applies to: ALL
Outcome: d) An ability to function on multi-disciplinary teams
Status: Introduced
Final Project Reports and Peer evaluations

5. Applies to: ALL
Outcome: e) An ability to identify, formulate, and solve engineering problems
Status: Introduced
Lab 4 and Final Project Reports

6. Applies to: ALL
Outcome: f) An understanding of professional ethical responsibility
Status: Introduced
Ethics Quiz and Reflection Essays

7. Applies to: ALL
Outcome: g) An ability to communicate effectively
Status: Introduced
Final Project Reports demonstrate written communication. Students also prepared posters and presented them at the senior design competition event.

8. Applies to: ALL
Outcome: h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
Status: Nothing
no comment

9. Applies to: ALL
Outcome: i) A recognition of the need for, and an ability to engage in, life-long learning
Status: Introduced
Lab 4 and Final Project Reports demonstrate the need to selection and study various components for integration into projects.

10. Applies to: ALL
Outcome: j) A knowledge of contemporary issues
Status: Introduced
Should be removed from EGR280. Was not really covered.

11. Applies to: ALL
Outcome: k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
Status: Introduced
Final project reports show the use of CodeWarier and lab equipment to develop the projects.

1. Applies to: CSE

Outcome: a) An ability to apply knowledge of computing and mathematics appropriate to the discipline
Status: Nothing
no comment

2. Applies to: CSE
Outcome: b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
Status: Nothing
no comment

3. Applies to: CSE
Outcome: c) An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs
Status: Nothing
no comment

4. Applies to: CSE
Outcome: d) An ability to function effectively on teams to accomplish a common goal
Status: Nothing
no comment

5. Applies to: CSE
Outcome: e) An understanding of professional, ethical, legal, security, and social issues and responsibilities
Status: Nothing
no comment

6. Applies to: CSE
Outcome: f) An ability to communicate effectively with a range of audiences
Status: Nothing
no comment

7. Applies to: CSE
Outcome: g) An ability to analyze the local and global impact of computing on individuals, organizations and society
Status: Nothing
no comment

8. Applies to: CSE
Outcome: h) Recognition of the need for, and an ability to engage in, continuing professional development
Status: Nothing
no comment

9. Applies to: CSE
Outcome: i) An ability to use current techniques, skills, and tools necessary for computing practice
Status: Nothing
no comment

10. Applies to: CSE
Outcome: j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices
Status: Nothing
no comment

11. Applies to: CSE
Outcome: k) An ability to apply design and development principles in the construction of software systems of varying complexity
Status: Nothing

no comment

1. Applies to: IT
Outcome: a) An ability to apply knowledge of computing and mathematics appropriate to the discipline
Status: Nothing
no comment

2. Applies to: IT
Outcome: b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
Status: Nothing
no comment

3. Applies to: IT
Outcome: c) An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs
Status: Nothing
no comment

4. Applies to: IT
Outcome: d) An ability to function effectively on teams to accomplish a common goal
Status: Nothing
no comment

5. Applies to: IT
Outcome: e) An understanding of professional, ethical, legal, security, and social issues and responsibilities
Status: Nothing
no comment

6. Applies to: IT
Outcome: f) An ability to communicate effectively with a range of audiences
Status: Nothing
no comment

7. Applies to: IT
Outcome: g) An ability to analyze the local and global impact of computing on individuals, organizations and society
Status: Nothing
no comment

8. Applies to: IT
Outcome: h) Recognition of the need for, and an ability to engage in, continuing professional development
Status: Nothing
no comment

9. Applies to: IT
Outcome: i) An ability to use current techniques, skills, and tools necessary for computing practice
Status: Nothing
no comment

10. Applies to: IT
Outcome: j) An ability to use and apply current technical concepts and practices in the core information technologies
Status: Nothing
no comment

11. Applies to: IT
Outcome: k) An ability to identify and analyze user needs and take them into account in the selection,creation, evaluation and administration of computer-based systems

Status: Nothing
no comment

12. Applies to: IT
Outcome: l) An ability to effectively integrate IT-based solutions into the user environment
Status: Nothing
no comment

13. Applies to: IT
Outcome: m) An understanding of best practices and standards and their application
Status: Nothing
no comment

14. Applies to: IT
Outcome: n) An ability to assist in the creation of an effective project plan
Status: Nothing
no comment

Comments? Questions? Contact the administrator

Exhibit E.7: Student Peer Evaluation Form for Senior Design

Peer Evaluation of Team Members
Please rate the degrees to which each member of your design group (including yourself) fulfilled his/her responsibilities in completing the work of your team. The possible ratings are:

- **Excellent:** Consistently went above and beyond - tutored teammates, carried more than his/her fair share of the work load.
- **Very Good:** Consistently did what he/she was supposed to do, very well prepared and cooperative.
- **Satisfactory:**

Usually did what he/she was supposed to do, acceptably prepared and cooperative.

- **Ordinary:** Often did what he/she was supposed to do, minimally prepared and cooperative.
- **Marginal:** Sometimes failed to show up or complete assignments, rarely prepared.
- **Deficient:** Often failed to show up or complete assignments, unprepared.
- **Unsatisfactory:** Consistently failed to show up or complete assignments, unprepared.
- **Superficial:** Practically no participation at all.
- **No Show:** No participation at all.

These ratings and comments should reflect each individual's level of participation, effort and sense of responsibility, and separately his/her academic ability.
Design Group #8

	Ratings
Tim A. If this is not you, click BACK and try again	Team rating: Academic rating:
Jacob C.	Team rating: Academic rating:

Sandi G.	Team rating: Academic rating:
Tim M.	Team rating: Academic rating:
Nashwan R.	Team rating: Academic rating:
Stephen S.	Team rating: Academic rating:
Tom S.	Team rating: Academic rating:
Overall comments:	

Input these characters: u*kpt*

Exhibit E.8: Senior Exit Questionnaire

The School of Engineering and Computer Science would like your assistance as you near the end of your degree program. Your thoughtful evaluation of your undergraduate experiences will help us review the structure, content and presentation of the program.

This questionnaire spans all of the required program components as well as some ancillary considerations. In addition, there are ample opportunities for comments. These comments are especially important to us, so please take the time to provide specific commentary.

Louay Chamra, Dean

Note: We ask you for your name and email address in order to develop a database of alumni for future surveys. Your responses are not stored with your name or email address and they cannot be associated with them when the data are analyzed.

First name: Last name:

Email address:

Program of Study:

General Education

Rate how well the courses you took to satisfy Oakland University´s General Education requirements enhanced your understanding and appreciation of that aspect of human experience:

Arts: Good

Literature: Good

Language: Good

Western civilization: Good

International studies: Good

Rate how well the study of **ethnic diversity** in the General Education portion of your program increased your understanding of the role ethnicity plays in human interaction: Good

Rate how well the study of **economics** gave you relevant insight to the practice of engineering: Good

Comments about the General Education component:

Mathematics and Science

The next several questions deal with the introductory mathematics and science courses you took as prerequisites to your engineering studies.

Where did you take your mathematics courses? All at Oakland University

If you took any mathematics courses at another institution, which school?

If you took mathematics at OU, rate the course(s) in preparing you for your engineering studies? Good

Rate how well the **physics** course(s) you took provided you a knowledge base that was helpful in your subsequent engineering studies: Good

Rate how well the **chemistry** course(s) you took provided you a knowledge base that was helpful in your subsequent engineering studies: Good

Comments about Mathematics and Science requirements:

Core Courses

The purpose of the core courses is to provide a broad base of topics required for higher-level study. Rate how well the following courses provided you with a broad base of knowledge and how well they improved your analytical skills:

Engineering core (Engineering majors only)
EGR 120 Computer Graphics and CAD
EGR 141 Computer Problem Solving in Engineering and Computer Science
EGR 240 Introduction to Electrical and Computer Engineering
EGR 250 Introduction to Thermal Engineering

EGR 260 Introduction to Industrial and Systems Engineering
EGR 280 Design and Analysis of Electromechanical Systems

Computer science core courses (Computer Science majors only)
EGR 141 Computer Problem Solving in Engineering and Computer Science
EGR 240 Introduction to Electrical and Computer Engineering
CSE 230 Object-Oriented Computing I
CSE 231 Object-Oriented Computing II
CSE 280 Sophomore Project
CSE 364 Computer Organization

Information Technology core courses (Information Technology majors only)
CIT 130 Introduction to Computer Programming
CIT 220 Spreadsheet Programming and Reporting
CIT 230 Object-Oriented Computing I
CIT 247 Introduction to Computer Networks
CIT 251 Web Programming

Knowledge Base	**Analytical Skills**
Good	Good

Comments about the core courses. Please list courses that were the most beneficial or the least beneficial to developing your knowledge base or analytical skills.:

Professional Courses

The objectives of the following professional courses are to provide a solid understanding of the principles of computer science or engineering and to develop the ability to apply analysis and design methodologies.

The professional courses in each program are:

Computer Engineering: CSE 230 Object-Oriented Computing I, CSE 231 Object-Oriented Computing II, CSE 247 Introduction to Computer Networks, CSE 364 Computer Organization, ECE 316 Circuits and Systems, ECE 327 Electronic Circuits and Devices, ECE 378 Digital Logic and Microprocessor Design, ECE 470 Microprocessor-based System Design

Computer Science:CSE 335 Programming Languages, CSE 337 Software Engineering and Practice, CSE 343 Theory of Computation, CSE 345 Database Design and Implementation, CSE 361 Design and Analysis of Algorithms, CSE 402 Social Implications of Computers, CSE 450 Operating Systems

Electrical Engineering: ECE 316 Circuits and Systems, ECE 327 Electronic Circuits and Devices, ECE 335 Signals and Systems, ECE 345 Electric and Magnetic Fields, ECE 351

Electromechanical Energy Conversion, ECE 378 Digital Logic and Microprocessor Design, ECE 384 Electronic Materials and Devices, ECE 431 Automatic Control Systems, ECE 437 Communication Systems

Information Technology: CIT 222 Interactive Multimedia Technology, CIT 248 Computer Systems, CIT 280 Sophomore Project, CIT 337 Software Engineering and Practice, CIT 345 Database Design and Implementation, CIT 350 Human Computer Interaction, CIT 352 System Analysis, CIT 402 Professional Practice

Industrial and Systems Engineering: ISE 318 Engineering Statistics and Economic Analysis, ISE 330 Engineering Operations Research, ISE 341 Work Methods and Ergonomics, ISE 469 Computer Simulation of Discrete Event Systems, ISE 480 E-Commerce and ERP, ISE 483 Production Systems and Workflow Analysis, ISE 485 Statistical Quality Analysis, ISE 487 Foundations of Systems Engineering, ISE 484 Flexible and Lean Manufacturing Systems

Mechanical Engineering: ME 308 Computer Aided Design, ME 322 Engineering Mechanics, ME 331 Introduction to Fluid and Thermal Energy Transport, ME 361 Mechanics of Materials, ME 372 Properties of Materials, ME 421 Vibrations and Controls, ME 486 Mechanical Systems Design, ME 456 Energy Systems Analysis and Design or ME 482 Fluid and Thermal Systems Design

Rate how well the required professional courses contributed to your understanding of engineering and your ability to apply analysis and design methodologies:

Principles and theory: Good

Application and design: Good

Comments about the required professional courses:

Capstone Senior Design experience

What aspects of your major did your senior design project(s) involve?

Did your senior design project(s) require you to draw from subject areas outside of your major?

If yes, which areas?

Did you feel that your senior design project was "real world" in nature?
Why or why not?

Did your senior design experience make you aware of any gaps in your background?
If yes, what were they?

Comments about your senior design experience:

Student Outcomes

Please rate the following statements:

I have the ability to apply knowledge of mathematics, science, and engineering.
Neither agree or disagree

I have the ability to design and conduct experiments, as well as to analyze and interpret data.
Neither agree or disagree

I have the 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.
Neither agree or disagree

I have the ability to function on multi-disciplinary teams.
Neither agree or disagree

I have the ability to identify, formulate, and solve engineering problems.

Neither agree or disagree

I have an understanding of professional and ethical responsibility.

Neither agree or disagree

I have the ability to communicate effectively.

Neither agree or disagree

I have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Neither agree or disagree

I have a recognition of the need for, and an ability to engage in life-long learning.

Neither agree or disagree

I have a knowledge of contemporary issues.

Neither agree or disagree

I have the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Neither agree or disagree

Comments:

Ethical Issues

From your observations, what percentage of undergraduate students do you believe cheat on **examinations**by copying from other students, using unauthorized notes or by pre-programming their calculators?

From your observations, what percentage of engineering students do you believe cheat on **laboratory reports** by submitting old reports as their own?

Please rate the following statement: The School of Engineering and Computer Science must place more emphasis in the curriculum on ethics.

Neither agree or disagree

What steps should the School of Engineering and Computer Science faculty take to minimize cheating? Please be specific.

Advising Services

Please rate the advising services provided during the years **before** you were granted major standing by the Advising Office: Good

Please rate the advising services provided by department faculty since you were granted major standing: Good

If you used the services of the OU Placement Office at any time, please rate how valuable you found the services: Good

Comments about advising:

Other

If you had any instructors who made those courses especially valuable to you, please name the instructors and briefly indicate what they did to make the courses especially valuable.

What else might OU in general, or the School of Engineering and Computer Science in particular, have done to better prepare you for your career?

Thank you

You have completed the questionnaire! Thank you very much for your feedback; it is deeply appreciated.

We also conduct periodic surveys of randomly selected alumni every few years. If you receive a request to submit an alumni questionnaire, we hope that you will complete it and let us know how your OU preparation has served you as a practicing engineer. Thank you again and good luck in your engineering career.

Input these characters: ***m m* x *d***

Submit information | Reset responses

Exhibit E.9: Employer Survey

School of Engineering and Computer Science - Department of Mechanical Engineering

* Required

Employer Survey Questionnaire

The ME department at Oakland University regularly solicits feedback on its programs and students to ensure that the department's mission is achieved. Employer surveys play an important role in this process. We would appreciate you taking 10 minutes to complete the survey below.

Thank you,
Zissimos Mourelatos
Professor and Chair, Mechanical Engineering Department

Please provide us with some information about yourself:

The following information will only be used to track participation. They will not be linked to your answers.

1. **Name** *

   ____

2. **Job Title** *

   ____

3. **Company/Organization** *

   ____

4. **Address**
   Street. City, State. Zip Code.

   ____
   ____
   ____
   ____
   ____

5. **Telephone**

   ____

6. **Email Address** *

   ____

Please rate the following questions:

7. **Indicate the approximate number of OU Mechanical Engineering graduates who form the basis for your responses to this questionnaire.** *
   Check all that apply.

   - [ ] 1-5
   - [ ] 6-10
   - [ ] More than 10

8. **Approximately how many of these have undergraduate degrees in Mechanical Engineering?** *
   Check all that apply.

   - [ ] 1-5
   - [ ] 6-10
   - [ ] More than 10

9. **Approximately how many of these have graduate degrees in Mechanical Engineering?** *
   Check all that apply.

   - [ ] 1-5
   - [ ] 6-10
   - [ ] More than 10

Questions about employees that hold OU undergraduate degrees in Mechanical Engineering

Program Educational Objectives -
Based on continuing input from our alumni, employers and faculty, the following skills have been identified as necessary for successful engineering practice. Our graduates are expected to be competent in these areas within 5 years of graduation. How do they rate in each area, especially compared to graduates of other institutions?

10. **Do they have the technical knowledge and skills necessary to function effectively in an engineering role within the automotive and other global industries?** *

    Mark only one oval.

    - Good
    - Fair
    - Poor

11. **Are they cognizant of the need for lifelong learning and are prepared to pursue successfully graduate study in mechanical engineering or other post-graduate education?** *

    Mark only one oval.

    - Good
    - Fair
    - Poor

12. **Do they have an awareness of ethical responsibility, and have the communication, problem-solving and teamwork skills necessary to function effectively in the modern multidisciplinary workplace?** *

    Mark only one oval.

    - Good
    - Fair
    - Poor

13. Please comment on the list of Program Educational Objectives above. Are there skills necessary for successful engineering practices that are not listed? Are there items in the list that should not appear? Should one or more of the objectives be rewritten to make it clearer?

____

____

____

____

____

Other characteristics of the Oakland graduate:

14. Distinctive features of our undergraduate Mechanical Engineering programs at Oakland are the interdisciplinary core curriculum, which provides breadth through a multidisciplinary systems approach to engineering, and lays the foundation for more specialized study in the student's major, and the emphasis on laboratory experience including teamwork. What has been the value of these to your company/organization? *

Mark only one oval.

- Good
- Fair
- Poor

15. Please feel free to comment on any of the issues above, and on any other strengths and/or weaknesses you observe in our graduates:

____

____

____

____

____

Questions about employees that hold OU graduate degrees in Mechanical Engineering

16. **Do you think that the Oakland Mechanical Engineering graduates have proper preparation to meet the basic professional needs of your company/organization? Please rate the level of preparation of Oakland University graduates.** *

Mark only one oval.

- Good
- Fair
- Poor

17. **Following up on the previous question, please rate the level of preparation of Oakland University graduates compared to graduates of other engineering schools.** *

Mark only one oval.

- Good
- Fair
- Poor

18. **Please comment on:**

1. Areas of study or specialized training that should be emphasized more.

____

____

____

____

____

19. 2. Capabilities of our students that have pleased you the most or least.

____

____

____

____

____

20. 3. Any other thoughts that you may have for improving our programs in Mechanical Engineering.

____

____

____

____

____

Thank you for your time and participation!

Signature Attesting to Compliance

By signing below, I attest to the following:

That Mechanical Engineering has conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely information regarding compliance with ABET's *Criteria for Accrediting Applied Science Programs* to include the General Criteria and any applicable Program Criteria, and the ABET *Accreditation Policy and Procedure Manual*.

_____Louay Chamra___________________________
Dean's Name (As indicated on the RFE)

________________________________ **___June 27, 2014___________**
Signature **Date**