Mechanical Engineering Program

The Bachelor of Science in Mechanical Engineering program is accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

A. Background Information

A.1 Degree Title

The degree title in the Mechanical Engineering (ME) Program is Bachelor of Science in Mechanical Engineering (BSME).

A.2 Program Modes

The Mechanical Engineering Program is primarily a day-mode program. Some classes are taught in the late afternoon and early evening to accommodate non-traditional students and students who work in local industries.

A.3 Contact Information

Program Chair:
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Department of Mechanical Engineering
1845 Fairmount
Wichita State University
Wichita, KS 67260-0133
Tel: 316-978-6319
Fax: 316-978-3236
E-mail: behnam.bahr@wichita.edu

Department Coordinator:
Dr. T. S. Ravi-guru-rajan, Ph.D., P.E.
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Wichita, KS 67260-0133
Tel: 316-978-6370
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E-mail: ts.ravi@wichita.edu
B. Accreditation Summary

The Department of Mechanical Engineering offers an ABET-accredited undergraduate degree in Bachelor of Science in Mechanical Engineering (BSME). It is responsible for development, assessment, review, and constant improvement of the program to satisfy its constituents. To meet ABET requirements, the full-time faculty defined a set of Program Educational Objectives and Outcomes. They continually enhance the already comprehensive curriculum and develop necessary assessment tools augmented by an effective feedback process.

Definition of Terms

Program Educational Objectives

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. These objectives provide prospective students, employers, alumni, and benefactors with a clear description of the purpose of the program over a timeframe of two to five or more years following graduation.

Program Outcomes

These are the expected results consequent to the implementation of the curriculum and must satisfy the various engineering requirements as stipulated by EAC 2007 Criterion 3 at the time of graduation.

Program Constituents

Constituents are the stakeholders who have a vested interest in the Mechanical Engineering Program.

Implementation Process

In spring 2002, the Dean of Engineering requested that various departments initiate a procedure to revamp the curriculum and follow-up on the ABET 2001 accreditation report. The faculty and curriculum committee, in particular, were entrusted with the charge of the curriculum overview. The College of Engineering (CoE) continued to have an ABET coordination committee consisting of members from all programs who monitored the changes in ABET guidelines and accreditation requirements. In fall 2005, this committee was reorganized as the CoE ABET Taskforce and charged with coordinating the continuing ABET activities in various departments and closely supervising the preparation of ABET 2007 activities.

CoE ABET Taskforce

The taskforce, charged with the overall coordination of ABET accreditation efforts of various departments, included the following:
• Two representatives from each department, one of whom is the department chair
• College ABET Coordinator

Specific Taskforce Duties

• Develop program objectives, assessment tools, and outcomes.
• Develop and conduct ABET short courses for the benefit of CoE faculty.
• Interact with the Fairmount College of Liberal Arts and Sciences on math/science curriculum requirements.
• Interact with other colleges concerning general education requirements.
• Coordinate efforts on student advising, including implementation of the Banner System during the Academic Year 2006–07.
• Coordinate and implement the required general education course, PHIL 385–Engineering Ethics.
• Develop Alumni Survey forms with a view to obtaining maximum feedback on programs.
• Coordinate with the Office of Career Services regarding student internship and cooperative education activities of engineering students, and promote employment-related activities among junior/senior students.

Following the directions of the CoE ABET Taskforce and the Departmental Assessment Committee, faculty actions and the mechanical engineering status are described detail in the following sections.

Assessment Process

The Mechanical Engineering Program received a Next General Review (NGR) accreditation with three concerns: faculty load, facilities, and faculty resources. The department focused on reviewing and strengthening the program to fit the changing requirements of its graduates in the new millennium. The program assessment process was overseen by several departmental committees.

Departmental Assessment Committees

The charge of these committees was to develop and assess the Mechanical Engineering Program, analyze Program Outcomes, and to recommend any changes to the program based on feedback.

Committee Members

The accreditation effort was led by senior professors of the department with able assistance from the junior faculty. To aid the process, the following subcommittees were formed:
Committee Tasks and Assignments

- To assess curriculum.
- To identify any issues.
- To recommend changes in courses.
  - To coordinate with instructors.
  - To hold discussions with instructors.
  - To determine course outcomes.
  - To receive feedback on course changes.
- To coordinate the program assessment process.
- To analyze Program Outcomes using all assessment tools.
- To review feedback from students, the Industry Advisory Board, and the Alumni Survey, among others.
- To suggest corrective action.
- To implement corrective measures with faculty approval.

A coordinator in collaboration with appropriate instructors was responsible for each course, its design, its relationship to ABET, and Program Outcomes. The table below provides a list of coordinators for various courses in the program.
<table>
<thead>
<tr>
<th>Coordinator</th>
<th>Alternate</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahmed</td>
<td>Koert</td>
<td>ME 502 Thermodynamics II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 650P Computational Thermal-Fluid Systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 750A Advanced Fluid Mechanics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 750P Computation Fluid Dynamics for Engineering Application</td>
</tr>
<tr>
<td>Asmatulu</td>
<td>Talia</td>
<td>ME 251 Materials Engineering Laboratory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 760 Fracture Mechanics</td>
</tr>
<tr>
<td>Bahr</td>
<td>Driessen</td>
<td>ME 325 Computer Applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 637 Computer-Aided Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 747 Microcomputer-Based Mechanical Systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 750N Advanced Computer-Aided Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 750C Intelligent Control</td>
</tr>
<tr>
<td>Driessen</td>
<td>Bahr</td>
<td>ME 659 Mechanical Control Systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 758 Nonlinear controls of Electro-Mechanical Systems</td>
</tr>
<tr>
<td>Koert</td>
<td>Ahmed, Ravi</td>
<td>ME 398 Thermodynamics I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 633 Mechanical Engineering Systems Laboratory</td>
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<tr>
<td></td>
<td></td>
<td>ME 650 Energy Conversion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 719 Basic Combustion Theory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 755 Intermediate Thermodynamics</td>
</tr>
<tr>
<td>Lankarani</td>
<td>Talia, Minaie</td>
<td>ME 339 Design of Machinery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 664 Introduction to Fatigue and Fracture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 729 Computer-Aided Analysis of Mechanical Systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 750 Impact Dynamics</td>
</tr>
<tr>
<td>Minaie</td>
<td>Lankarani</td>
<td>ME 439 Mechanical Engineering Design I</td>
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<tr>
<td></td>
<td></td>
<td>ME 541 Mechanical Engineering Design II</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Applications of Finite Element Methods in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 639 Mechanical Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 762 Polymeric Composite Materials</td>
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<tr>
<td>Ravi</td>
<td>Siginer</td>
<td>ME 521 Fluid Mechanics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 544 Design of HVAC Systems</td>
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<tr>
<td></td>
<td></td>
<td>ME 631 Heat Exchanger Design</td>
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<tr>
<td></td>
<td></td>
<td>ME 650A Design of BioMEMS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 750Z Bio-Thermal Fluid Engineering</td>
</tr>
<tr>
<td>Siginer</td>
<td>Ahmed</td>
<td>ME 522 Heat Transfer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 650A Introduction to Bio-Fluids</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 750F Model of Engineering Systems</td>
</tr>
<tr>
<td>Soschinske</td>
<td>Driessen</td>
<td>ME 533 Mechanical Engineering Laboratory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 662 Mechanical Engineering Practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 669 Acoustics</td>
</tr>
<tr>
<td>Talia</td>
<td>Asmatulu</td>
<td>ME 250 Materials Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 664 Introduction to Fatigue and Fracture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 665 Selection of Materials for Design and Manufacturing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 666 Materials in Manufacturing Processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 667 Mechanical Properties of Materials I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Applications of Finite Element Analysis Using Algorithms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME 750M Algorithms</td>
</tr>
</tbody>
</table>
B.1  Students

This section describes how students are evaluated, advised, and monitored in a manner consistent with program objectives, as required by EAC Criterion 1.

Enrollment

Since 2002, Mechanical Engineering Program enrollment has ranged from 249 to 324. This includes students who have declared mechanical engineering as a co-major. Student enrollment trends over the past six years are shown in Table B.1.1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Spring (number enrolled)</th>
<th>Fall (number enrolled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>324/19</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>269/29</td>
<td>260/24</td>
</tr>
<tr>
<td>2005</td>
<td>265/25</td>
<td>271/12</td>
</tr>
<tr>
<td>2004</td>
<td>265/24</td>
<td>267/19</td>
</tr>
<tr>
<td>2003</td>
<td>249/24</td>
<td>267/23</td>
</tr>
<tr>
<td>2002</td>
<td>262/30</td>
<td>266/32</td>
</tr>
</tbody>
</table>

Credit Hour Definition

The department follows the university wide standard definition of a credit hour. Excluding the final examination week, one semester credit hour represents one class hour per week with a stipulated duration of 50 minutes. Based on the definition of a 15-week semester, a typical three-credit hour class consists of 45 hours of contact hours.

Grading Policies

University grading policies may be found in the undergraduate catalog. The common grading policy is as follows:

- **A**: Distinguished achievement; credit given; four credit points per semester hour.
- **B**: Superior achievement; credit given; three credit points per semester hour.
- **C**: Average achievement; credit given; two credit points per semester hour.
- **D**: Below average achievement; credit given; one credit point per semester hour.
- **F**: Failing work; no credit earned toward graduation; zero credit points per semester hour.
- **W**: Withdrawal from course; no credit given.
- **Au**: Audit; no credit given.
- **Cr**: Credit (A, B, or C); credit given; no credit points.
- **NCr**: No credit (D or F); no credit given.
- **S**: Satisfactory (A, B, or C); credit given; no credit points assigned.
U  Unsatisfactory (D or F); no credit given.
I  Incomplete; temporary grade for incomplete work; no credit given; no credit points.
R  Repeat; prefix to other grading symbols indicating that the course is a repeat of one taken earlier.
CrE Credit by examination in lieu of formal enrollment in college coursework; credit given; no credit points.

B.1.1 Evaluation Process

Evaluation and advising begin at the outset when students join the Mechanical Engineering Program. Incoming freshmen take math and English placement tests. Students who can show evidence of two years of algebra, one year of geometry, and a half-year of trigonometry (all with a grade of C or better) and an ACT score of 20 are allowed to take calculus courses. Domestic freshmen with an ACT score of 20 or satisfactory performance in the English placement test can enroll in ENGL 101 College English. All international students must pass the English placement test, following which they are allowed to enroll in ENGL 100. TOEFL or EPE are used only for purposes of admission to the university.

With specific attention to Criterion 3, the student evaluation documents are maintained in the course portfolio for each specific undergraduate course. These include those graduate courses taken by one or more undergraduate students.

The College of Engineering Records Office maintains a complete file on the academic program and progress of each student. This file contains all academic records and related correspondence and documents for the student, including the following:

- Transcript, updated at the completion of each semester.
- Computer-generated degree audit sheet tailored to the mechanical engineering curriculum, which shows courses completed in required categories and separate sections detailing math and science, humanities and social sciences, engineering major, and other credits.
- Cumulative grade point averages in the three categories—overall GPA (including transfer credit), GPA for courses taken at Wichita State University, and GPA in the major.
- Copies of all correspondence of an academic nature with the student, including letters of admission to the College of Engineering.
- Letters informing the student of academic action, such as being placed on the honor roll or being placed on probation.
- Any exceptions to the rules filed by the student and any action taken on those exceptions.
- Any comments or instructions included by the student’s faculty advisor, department chair, Engineering Records Office, or other pertinent source.
- Any supplementary information used in transcript evaluations of transfer credit.

Staff of the Engineering Records Office maintains all files and other pertinent records for the academic program. They also provide assistance in reviewing files to ensure that students are following their program and meeting any conditions of their enrollment, such as reduced hours for students on probation.
B.1.2 Advising Process

Full-time faculty members in the Department of Mechanical Engineering advise students who have selected mechanical engineering as their major. This includes both pre-engineering students who have declared mechanical engineering as their major and mechanical engineering majors accepted into the College of Engineering. All new students are assigned to the program’s undergraduate coordinator upon entering the program. During the middle of the first semester, they are assigned to various faculty members within the program. The assignment is random and based on balancing the load among faculty members. Thus, a new student coming to the department will be assigned to the faculty member with the smallest number of advisees. This assignment is continued throughout the student’s academic program to provide continuity and consistent advising for the student. The student is free to change advisors by simply notifying the engineering Student Records Office (SRO) so that records can be updated to indicate the new assignment.

Each semester during periods of preregistration or registration, the student is required to meet with a faculty advisor to review his/her progress and develop a schedule of courses to be taken during the next semester. Before each semester’s preregistration period, each student is reminded, by mail, of advising schedules. The Department of Mechanical Engineering determined that a standardized advising process needed to be developed and posted to make students aware of the correct procedures for being advised. This process, shown in Figure B.1.1, is posted throughout the department, and is available on the department website, http://www.wichita.edu/mechanical. The faculty meets and discusses one-on-one with the student about the long-term strategy of his/her curriculum. The faculty advises and helps the students develop career goals and chart out a course of action to achieve those goals. The CoE, in spring 2006, developed the Advising Checksheet and Survey (Figure B.1.2), to ensure that the student is properly prepared for his/her appointment as well as record the student’s satisfaction regarding this meeting. Input from ME freshmen, sophomores, juniors, and seniors were collected during spring 2006 and the data is provided in Table B.1.2. The data show satisfaction on the part of students regarding career, courses, and professional advising by the program faculty. This form also provides feedback to the department about advising quality, an issue which merits close review. The advising process and survey will be modified as necessary and adapted for regular use.

During the advising appointment, the student and advisor use the student’s file, transcript, a variety of reports available to faculty through an online information system (Banner), departmental checksheets, etc. to develop a schedule of classes. This process provides the best progress toward meeting the requirements in all areas, and making sure that all prerequisite and other preliminary restrictions have been satisfied. The sample mechanical engineering curriculum chart is quite useful in that the prerequisites (P) and corequisites (C) for each course are shown immediately below that course (Table B.1.3). General education (Gen Ed) program requirements are also described on the sample curriculum sheet.
Mechanical Engineering Advising Process

The Department of Mechanical Engineering (ME) takes the advising process seriously. Advising should be an efficient interaction between you and a faculty member, oriented toward monitoring progress and making appropriate decisions. Here are the steps you will follow:

Step 1  **Make an appointment to see your advisor:**
- Have the records office or ME department staff identify your assigned advisor if you don’t know who it is.
- Contact your advisor by e-mail to make an appointment, at least one week in advance.
- In extreme cases, when your advisor is unavailable, make an appointment by e-mail at least one-week in advance with the department chairperson.

Step 2  **Prior to the appointment, outline, to the best of your ability, a tentative class schedule:**
- Keep in mind that your advisor will review the schedule, help with problems, answer questions, offer suggestions, and discuss career plans (if you desire).
- Be aware, your advisor is there to help, but you have the ultimate responsibility for academic planning and progress.

Step 3  **Show up prepared and on time for the advising appointment:**
- Pick up your advising record and complete the appropriate parts of the “College of Engineering Advising Checksheet and Survey” form prior to the appointment (records and forms are located in WH 108).
- Expect to talk with your advisor about your academic status, questions, and plans.
- After meeting with your advisor, return the completed survey portion of the “College of Engineering Advising Checksheet and Survey” and your advising record to WH 108.

3/29/07, ME Advising Process

Figure B.1.1. The Mechanical Engineering Advising Process.
College of Engineering
Advising Checksheet and Survey
Spring 2006

Department: _________  Classification (check one):  Fr. ___ So. ___ Jr. ___ Sr. ___

This checksheet must be filled out prior to receiving your advising folder from the Engineering Student Records Office. The survey should be filled out after meeting with your advisor and then returned with your folder to the Engineering Student Records Office.

Checksheet:
1. I have made an appointment with my assigned advisor: yes_____ no _____
2. I have previously discussed my career goals with my advisor: yes_____ no _____
3. I would like to discuss my career goals with my advisor today: yes_____ no _____
4. I would like to take the following courses:

<table>
<thead>
<tr>
<th>Section Number</th>
<th>Department/ Course Number</th>
<th>Days/Times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. I have checked to be sure that I have the prerequisites for these courses: yes_____ no _____

Survey:
Please check or rank the following that apply to your advising experience:

1. My advisor kept our scheduled appointment: yes_____ no _____
2. My overall advising experience was good agree 5 4 3 2 1 disagree
3. It was easy to schedule an appointment with my advisor: agree 5 4 3 2 1 disagree
4. My advisor gave me good information on what courses to take: agree 5 4 3 2 1 disagree
5. My advisor took interest in my academic progress: agree 5 4 3 2 1 disagree
6. My advisor took interest in my professional career: agree 5 4 3 2 1 disagree

Please provide any additional comments or suggestions for improvement on the back of this

Figure B.1.2. CoE Advising Checksheet and Survey.

Table B.1.2. Spring 2006 Data on Student Advising Survey

<table>
<thead>
<tr>
<th>Rating of Advising</th>
<th>42 Y / 1 N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My advisor kept our scheduled appointment:</td>
<td>Score 5 4 3 2 1</td>
</tr>
<tr>
<td>2. My overall advising experience was good:</td>
<td>35 4 2 0 3</td>
</tr>
<tr>
<td>3. It was easy to schedule an appointment with my advisor:</td>
<td>38 2 2 1 1</td>
</tr>
<tr>
<td>4. My advisor gave me good information on what courses to take:</td>
<td>33 7 1 0 3</td>
</tr>
<tr>
<td>5. My advisor took interest in my academic progress:</td>
<td>29 7 4 1 2</td>
</tr>
<tr>
<td>6. My advisor took interest in my professional career:</td>
<td>29 7 3 1 4</td>
</tr>
</tbody>
</table>
### Table B.1.3. Mechanical Engineering Curriculum Chart

#### MECHANICAL ENGINEERING CURRICULUM

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Sophomore Year</th>
<th>Junior Year</th>
<th>Senior Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Spring</td>
<td>Fall</td>
<td>Spring</td>
</tr>
<tr>
<td>ENGL 100/101</td>
<td>ENGL 102</td>
<td>COMM 111</td>
<td>PHIL 385</td>
</tr>
<tr>
<td>College Eng I</td>
<td>College Eng II</td>
<td>Public Speaking</td>
<td>Engineering Ethics</td>
</tr>
<tr>
<td>(3)</td>
<td>(3)</td>
<td>(3)</td>
<td>(3)</td>
</tr>
<tr>
<td>P: ENGL 013</td>
<td>P: ENGL 101</td>
<td></td>
<td>P: ME 251</td>
</tr>
<tr>
<td>or Placement</td>
<td></td>
<td></td>
<td>P: AE 333</td>
</tr>
<tr>
<td>Exam</td>
<td></td>
<td></td>
<td>P: MATH 555</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 242</td>
<td>MATH 243</td>
<td>ME 250</td>
<td>ME 502</td>
</tr>
<tr>
<td>Calculus I (5)</td>
<td>Calculus II (5)</td>
<td>Materials</td>
<td>Thermodynamics II (3)</td>
</tr>
<tr>
<td>P: See Catalog</td>
<td>P: MATH 242</td>
<td>Engineering</td>
<td>P: ME 398</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laboratory (1)</td>
<td>P: MATH 243</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Fine Arts)</td>
<td>P: PHYS 313</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 211</td>
<td>PHYS 313</td>
<td>MATH 344</td>
<td>ME 339</td>
</tr>
<tr>
<td>General</td>
<td>University</td>
<td>Calculus III (3)</td>
<td>Design of</td>
</tr>
<tr>
<td>Chemistry (5)</td>
<td>Physics I (4)</td>
<td>(3)</td>
<td>Machinery (3)</td>
</tr>
<tr>
<td>P: See Catalog</td>
<td>C: MATH 243</td>
<td>P: MATH 243</td>
<td>P: IME 222</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P: MATH 243</td>
<td>C: AE 373</td>
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<td>PHYS 315</td>
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<td>AE 333</td>
<td>ME 533</td>
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<tr>
<td>University</td>
<td>University</td>
<td>Mech of</td>
<td>Mech. Engr</td>
</tr>
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<td>Physics Lab I</td>
<td>Physics II (4)</td>
<td>Materials</td>
<td>Lab (3)</td>
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<td>(1)</td>
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<td>(3)</td>
<td>P: ECE 282</td>
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<tr>
<td>(1)</td>
<td>P: MATH 243</td>
<td>P: MATH 344</td>
<td>P: AE 333</td>
</tr>
<tr>
<td>C: PHYS 313</td>
<td></td>
<td></td>
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<td>ME 521</td>
<td>ECE 282</td>
<td>IME 255</td>
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<tr>
<td>Fluid Mechanics (3)</td>
<td>P: ME 398</td>
<td>Circuits I (4)</td>
<td>Engineering Economy (3)</td>
</tr>
<tr>
<td>P: CHEM 211</td>
<td>P: MATH 555</td>
<td>P: AE 373</td>
<td>C: MATH 243</td>
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<tr>
<td>C: AE 223</td>
<td>P: MATH 344</td>
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<tr>
<td></td>
<td>AE 223</td>
<td>ECE 383</td>
<td>ME 662</td>
</tr>
<tr>
<td>Statics (3)</td>
<td>C: MATH 243</td>
<td></td>
<td>Mech Engr</td>
</tr>
<tr>
<td>(3)</td>
<td>C: PHYS 313</td>
<td></td>
<td>Practice (3)</td>
</tr>
<tr>
<td></td>
<td>AE 373</td>
<td></td>
<td>P: (ECE 282</td>
</tr>
<tr>
<td></td>
<td>Dynamics (3)</td>
<td></td>
<td>and MATH 555)</td>
</tr>
<tr>
<td></td>
<td>P: AE 223</td>
<td></td>
<td>P: ECE 383</td>
</tr>
<tr>
<td></td>
<td>P: MATH 344</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: 16 hrs</td>
<td>Total: 16 hrs</td>
<td>Total: 17 hrs</td>
<td>Total: 18 hrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. WSU general education (Gen Ed) requirements; guidelines are provided below.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. ME 541, ME 637, ME 639, ME 729, ME 737, ME 747, or check with your advisor for other courses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ME 544, ME 631, ME 641, ME 469, or check with your advisor for other courses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Mechanical engineering courses 400 or higher, or check with your advisor for other courses.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**128 Hours minimum**

Courses listed in bold are only offered once a year.

Prerequisite courses must be completed with a grade of C or better.

### GUIDELINES FOR TAKING WSU GENERAL EDUCATION PROGRAM COURSES

<table>
<thead>
<tr>
<th></th>
<th>Option One</th>
<th>Option Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Arts</td>
<td>one Introductory course</td>
<td>one Introductory course</td>
</tr>
<tr>
<td>Humanities</td>
<td>two Introductory courses in two different disciplines/programs (one must be in philosophy)</td>
<td>one Introductory course</td>
</tr>
<tr>
<td></td>
<td>PHIL 385 Engineering Ethics</td>
<td>PHIL 385 Engineering Ethics</td>
</tr>
<tr>
<td>Social and Behavioral Sciences</td>
<td>one Introductory course</td>
<td>two different courses in two different areas</td>
</tr>
<tr>
<td></td>
<td>one Issues and Perspectives course</td>
<td>one Further Studies course in one of the above areas</td>
</tr>
</tbody>
</table>
**Degree Check**

The department chair meets with graduating students to evaluate his/her academic record prior to the preceding preregistration period. “Degree Requirements Checksheet” worksheet (Figure B.1.3) is used by the chair to ensure that all graduation requirements have been met or will be met by the expected graduation date. This evaluation also ensures that the ABET general and ME program criteria are fulfilled.

**DEGREE REQUIREMENTS CHECKSHEET for B.S.M.E. Candidates**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credit Hours</th>
<th>Required</th>
<th>Completed</th>
<th>In Progress</th>
<th>To Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Science</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Arts</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philosophy 385</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humanities (maximum two different departments from list)</td>
<td>(3 or 6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social and Behavior Sciences (two different departments from list)</td>
<td>(3 or 6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Further Studies Course in Humanities or Social Sciences</td>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Gen Ed Courses</strong></td>
<td><strong>18</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Departmental Requirements**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credit Hours</th>
<th>Required</th>
<th>Completed</th>
<th>In Progress</th>
<th>To Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tech. Elec. “Mechanical Design”</td>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tech. Elec. “Thermal Design”</td>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Technical Electives</strong></td>
<td><strong>6</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Courses to Complete</th>
<th>Credit Hours</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Total Credits Required to Graduate:**

**Other Comments:**

1. Assumes satisfactory completion of all “in progress” courses.

---

Figure B.1.3. Degree Requirements Checksheet.

**Probation Process**

Mechanical Engineering Program Self-Study 2007
The primary academic evaluation mechanism is the course grades from instructors. Based on these grades, three grade point averages (GPA) are computed for each student: (1) semester GPA (SGPA), (2) engineering GPA (EGPA), and (3) WSU GPA (WGPA). The SGPA is used as an indicator of student performance during that specific semester. Unless a student is already on “Probationary Status,” the SGPA does not impact the student’s status. WGPA is a cumulative GPA of all program-required courses taken at WSU. EGPA is the cumulative GPA of all required courses taken at WSU, except general education (including communications), math, and science courses. At the end of any semester, if either the WGPA or the EGPA falls below 2.00, the student is placed on “Probationary Status.” While on “Probationary Status,” if the SGPA achieved is less than 2.0, the student is dismissed from the college if the probation resulted from EGPA, or from the university if the probation resulted from WGPA. An expelled student can appeal his/her dismissal to the College of Engineering Exceptions Committee or University Exceptions Committee, depending on whether he/she has been dismissed from the college or university. A student cannot graduate while on “Probationary Status.” These evaluations are performed at the college level following the flow diagram shown in Figure B.1.4, which explains this process.

![Flow Diagram of Semester Evaluation of Students](image_url)

**Figure B.1.4. Flow Diagram of Semester Evaluation of Students.**

### B.1.3 Checks and Controls

A faculty advisor meets the student and discusses the schedule and goals of the student, and fill them out in a schedule form. The Engineering Records Office staff carries out a comprehensive check to identify any problems. If no problems are found, the associate dean or his representative approves the tentative schedule, and the student completes the preregistration or registration process.
Each student is required to have his/her file reviewed by the department chair before registering for his/her last semester to ensure that all graduation requirements will be met as described in section B.1.1, under Degree Check. The student can request this check earlier if he/she desires. The chair checks the records of the student, conducts a degree audit, and completes a Degree Requirements Checksheet (Figure B.1.3). This completed graduation requirements sheet gives a list of the courses that will be needed to complete the degree requirements and meet all ABET criteria. The Engineering Records Office assists the chair in this final check process by preparing the files for review and checking them again for any errors or discrepancies.

The College of Engineering’s electronic degree audit for each program is being replaced by a university wide degree audit system. All advising materials and a paper copy of the electronic degree audit are kept in an “Academic Records Folder” (ARF) for each student. In addition, the department has developed a curriculum chart (Table B.1.3), which is made available to all students. This chart shows the recommended sequence of courses and clearly indicates the course prerequisites. Students bring their ARF from the engineering Student Records Office when they meet for advising, and the checksheet is available in the department for review at this time. Faculty members have access to the electronic degree audit as well as student academic records via the university computer system.

B.1.4 Substitutions

Substitutions to requirements may be made only upon the recommendation of the advisor and with the approval of the appropriate individual or committee, as explained below. In general, substitutions are made only under those circumstances that will assure the student’s educational experience equivalent to that which would be obtained with the approved program curriculum. The following exceptions policies apply to substitutions:

**Exceptions to University General Education Requirements**

These exceptions must be approved by the student’s advisor, undergraduate coordinator (or department chair), and Associate Dean of the College of Engineering.

**Exceptions to Engineering Core and Other College Regulations**

These exceptions must be approved by the student’s advisor, undergraduate coordinator (or department chair), and Associate Dean of the College of Engineering.

**Exceptions to Department Requirements**

These exceptions are solved in various ways. One is to examine whether a course in another department would provide the student an equivalent exposure to topics in the required course. If no such course can be found, an attempt is made to find a faculty member who would be willing to supervise the student in independent studies or special topics course with equivalent material to the required course. In nearly all cases, the advisor (working with the undergraduate coordinator) and the student arrive at a mutually agreeable solution, which is then proposed to the department chair. If the chair approves, a note is included in the student’s file approving the substitution.
B.1.5 Policies for Accepting Transfer Students/Credits

Wichita State University is a metropolitan university with a significant number of students transferring from other four-year colleges and community colleges. In addition, WSU and the College of Engineering have agreements with regional institutions on mutual transfer of courses. Additionally, international students transfer to the Mechanical Engineering Program after taking many of the basic science, math, and engineering core courses at overseas institutions.

It is the policy of Wichita State University to accept all credits (with the exception of remedial coursework) earned at an accredited college. Each academic college or department within WSU determines how those credits apply toward a particular degree program. Sometimes there can be a wide gap between what “transfers” and what counts toward a degree, especially if the courses taken are highly technical in nature. For instance, any design courses taken at another university will not fulfill WSU ME curriculum requirements, although they will count as general credits.

Any college course not listed as having an equivalent from any program area is accepted as a “Free Elective.” Remedial courses are excluded from this category and do not count for credit. Courses from vocational/technical and agricultural-related areas are included as free electives, and those credits are transferred.

Graduation from WSU requires a minimum of 124 credit hours (note: the ME Program requires 128 hours), with at least 60 of those hours taken at a four-year institution and 45 of those hours taken at the upper-division level. Students seeking a bachelor’s degree should be encouraged to take no more than 64 hours at a community college.

Students desiring to transfer into the ME Program are evaluated according to WSU and College of Engineering transfer credit policies and practices. All students desiring to transfer to WSU must have a minimum cumulative GPA of 2.0. Students who do not meet this minimum requirement but can demonstrate extenuating conditions must apply for exception. These applicants are evaluated by the University Exceptions Committee and, if approved, are admitted on probationary status. While on probationary status, students must attain a GPA of at least 2.0 in each semester. Students remain on probationary status until the condition for which they were placed on probation is removed. All acceptable transfer credit must have been earned with at least a “C” grade. See Figure B.1.5 for a flow diagram of the transfer course acceptance process.

The WSU Office of Admissions first evaluates a transfer student’s records. After it determines which courses are acceptable to the university, the College of Engineering evaluates each transcript for the program indicated by the student. The engineering Student Records Office manager, under the supervision of the associate dean, performs this evaluation. College catalogs and the Designated Transfer Credit Practices of Designated Institutions (AACRAO) document are used as sources for this evaluation. If an institution is not well known, the SRO may contact persons at an ABET university in a given state to assist in the determination.

In those cases where equivalence is not clear, the chair of the department offering the course at Wichita State University is requested to make an evaluation and recommendation concerning transfer of credits. These decisions are generally based on examination of catalog descriptions, review of textbooks and student work, and, in some cases, an interview or quiz with the student.
requesting the transfer of credit. Careful attention is given to the prerequisite structure of the institution, which offered the course. The result of this evaluation is recorded on a form provided for this purpose and becomes part of the student’s file.

If doubt still exists concerning the equivalency of a course, the material is referred to the instructor who is responsible for this course. This instructor, through a discussion with the student, makes a determination as to the student’s knowledge of the subject and makes a recommendation to the department chair. Final approval of transfer is the responsibility of the chair of the student’s major department.

The SRO, under the supervision of the associate dean, makes an evaluation of transfer courses in mathematics, basic sciences, humanities and fine arts, and social and behavioral sciences. In cases where questions exist, the appropriate department is requested to make an evaluation and recommendation.
Figure B.1.5. Transfer Course Acceptance Process.
B.1.6 Incoming Student Quality

By the state of Kansas’ requirement, WSU is an open-admission university. That is, any graduate of a Kansas high school is guaranteed admission to the university. Beginning with members of the Class of 2001, students entering WSU must meet the requirements shown in Table B.1.4.

Table B.1.4. Requirements for Admission to WSU

<table>
<thead>
<tr>
<th>To Be Admitted</th>
<th>Students Must Meet These Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kansas residents must:</strong></td>
<td>1. Achieve an ACT composite score of 21 or above or a minimum combined SAT-I score of 980, <strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>2. Rank in the top one-third of their high schools’ graduating class, <strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>3. Complete the precollege curriculum with at least a 2.0 grade point average on a 4.0 scale.</td>
</tr>
<tr>
<td><strong>Non-residents must:</strong></td>
<td>1. Achieve an ACT composite score of 21 or above or a minimum combined SAT-I score of 980, <strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>2. Rank in the top one-third of their high schools’ graduating class, <strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>3. Complete the precollege curriculum with at least a 2.5 grade point average on a 4.0 scale.</td>
</tr>
<tr>
<td><strong>Non-accredited high school or home-schooled students must:</strong></td>
<td>1. Achieve an ACT composite score of 21 or above <strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>2. Achieve a minimum combined SAT-I score of 980.</td>
</tr>
<tr>
<td><strong>GED students must:</strong></td>
<td>1. Have a minimum score of 510 on each subtest and an overall score of 2550, <strong>AND</strong></td>
</tr>
<tr>
<td></td>
<td>2. Submit official ACT or SAT scores.</td>
</tr>
<tr>
<td><strong>Transfer students with 24 or more hours must:</strong></td>
<td>Have a minimum cumulative GPA of 2.0 on a 4.0 scale on all previous college work.</td>
</tr>
<tr>
<td><strong>Transfer students with fewer than 24 hours must:</strong></td>
<td>1. Have a minimum cumulative GPA of 2.0 on a 4.0 scale on all previous college work.</td>
</tr>
<tr>
<td></td>
<td>2. Meet one of the freshmen qualified admissions requirements.</td>
</tr>
</tbody>
</table>

The Regents’ Qualified Admissions Pre-College Curriculum requires the following:
Four units of English.
Three units of Natural Science (must include one unit of Chemistry or Physics).
Three units of Social Sciences.
One unit of Computer Technology.

If students do not meet the university’s admission requirements, they can appeal to the exceptions committee for admission to the university and the College of Engineering. Some students will be admitted to the College of Liberal Arts and Sciences until the successful completion of 12 credit hours, at which time they can transfer to a major program such as engineering.

Transfer students must present an earned GPA of 2.0 or higher on a 4.0 scale for all prior college work in order to be fully admitted to Wichita State University. Transfer students with a GPA of less than 2.0 must petition the university and the college for probationary admission.

Students seeking admission as freshmen are not required to submit ACT or SAT scores. However, many students do voluntarily submit these scores. Table B.1.5 summarizes the average ACT scores of incoming freshmen over the past five-year period. As shown, ME students have scores in line with the College of Engineering and consistently higher than the university average.

Table B.1.5. Incoming Student ACT Scores

<table>
<thead>
<tr>
<th>Category</th>
<th>Fall 2002</th>
<th>Fall 2003</th>
<th>Fall 2004</th>
<th>Fall 2005</th>
<th>Fall 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average ACT</td>
<td>21.57</td>
<td>21.64</td>
<td>21.95</td>
<td>22.03</td>
<td>22.13</td>
</tr>
<tr>
<td>Average Math ACT</td>
<td>21.01</td>
<td>21.13</td>
<td>21.41</td>
<td>21.54</td>
<td>21.65</td>
</tr>
<tr>
<td>Number of Reports</td>
<td>6,340</td>
<td>6,452</td>
<td>6,261</td>
<td>6,270</td>
<td>6,195</td>
</tr>
<tr>
<td><strong>College</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average ACT</td>
<td>22.97</td>
<td>23.28</td>
<td>23.70</td>
<td>24.10</td>
<td>24.38</td>
</tr>
<tr>
<td>Average Math ACT</td>
<td>24.69</td>
<td>24.85</td>
<td>25.22</td>
<td>25.33</td>
<td>25.56</td>
</tr>
<tr>
<td>Number of Reports</td>
<td>507</td>
<td>528</td>
<td>493</td>
<td>539</td>
<td>552</td>
</tr>
<tr>
<td><strong>ME Program</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average ACT</td>
<td>22</td>
<td>22.43</td>
<td>22.76</td>
<td>23.61</td>
<td>23.82</td>
</tr>
<tr>
<td>Average Math ACT</td>
<td>23.86</td>
<td>24.11</td>
<td>24.03</td>
<td>24.57</td>
<td>24.85</td>
</tr>
<tr>
<td>Number of Reports</td>
<td>111</td>
<td>130</td>
<td>121</td>
<td>139</td>
<td>162</td>
</tr>
</tbody>
</table>
B.2 Program Educational Objectives (PEOs)

Wichita State University

Wichita State University is committed to providing comprehensive educational opportunities in an urban setting. Through teaching, scholarship, and public service, the university seeks to equip both students and the larger community with the educational and cultural tools needed to thrive in a complex world and to achieve both individual responsibility in their own lives and effective citizenship in the local, national, and global communities.

College of Engineering

Vision

The College of Engineering at Wichita State University will be recognized nationally and internationally for the following: its experience-based undergraduate and graduate degree programs; its collaborative efforts with industry; and its research programs that support the economic development and global competitiveness of the Wichita metropolitan area, the state of Kansas, and the nation.

Mission

The College of Engineering at Wichita State University is committed to the following:

- Preparing graduates who will engage effectively and responsibly in the practice of the engineering profession in a global economy and in pursuing advanced engineering education.
- Conducting applied and basic research to support and contribute to the social and economic well-being of citizens and organizations in the Wichita metropolitan area, the state of Kansas and beyond.
- Cultivating the spirit of entrepreneurship and the connection between engineering and business that encourages technology commercialization.
- Improving continuously the engineering pedagogical methods employed in delivering its academic programs.
- Fostering and valuing diversity of ideas and people through early student recruitment, outreach programs, and the recruitment and development of faculty role models.
- Encouraging scholarship in all its dimensions.
- Evolving thoughtfully in response to the needs of industry and the changing world.

Mechanical Engineering Program

Vision

The Mechanical Engineering (ME) Program will be nationally and internationally recognized for outstanding education and research.

Mission
The Mechanical Engineering Program at Wichita State University is committed to the following:

- Providing students with a broad mechanical engineering education.
- Helping advance the mechanical engineering profession.
- Contributing toward the economic development of the state of Kansas.

This section describes the Mechanical Engineering Program Educational Objectives (PEOs) and the process through which the objectives are established, evaluated, and continuously improved.

The vision and mission of the Mechanical Engineering Program are in line with those of the College of Engineering. The program is designed and geared to produce engineering graduates who can practice their profession within the metropolitan area and beyond. The engineers of this program will have gained broad education that will contribute toward the development of the larger metropolitan area and the larger community of Kansas, which are also the basic mission of the university. The program aims to impart educational and cultural tools necessary for the engineering profession in today’s globalized industry.

**B.2.1 Objectives**

The new Program Educational Objectives of the Mechanical Engineering Program, as adopted by its constituents in fall 2006 and currently followed by the program, are as follows:

- **PEO-1:** Educate students to be successful mechanical engineers in their professions in a global environment.
- **PEO-2:** Prepare students to pursue life-long learning.
- **PEO-3:** Prepare students for real-world problems by working on industry-based projects.

The PEOs of the Mechanical Engineering Program are consistent with the vision and mission of the College of Engineering. Aiming to produce successful mechanical engineers in a global environment, they are in tune with the CoE’s mission of producing engineers capable of working in metropolitan area industries. Wichita and Kansas industries are increasingly involved in global collaboration and design activities. The program’s graduates, with their industry-based project experience and their life-long learning qualities, play an important role in fulfilling the mission of the university and the CoE, which places emphasis on regional development and growth through education, research, and service. The new PEOs are available on the Department of Mechanical Engineering’s web page (www.wichita.edu/mechanical), are included in the information sent to potential students, and will be published in the next WSU undergraduate catalog (www.wichita.edu/catalog).

**B.2.2 Program Constituencies**

Primary constituents are the main stakeholders of the program and the PEOs are directly influenced by them. Their input, discussions, and guidance are key to establishing credible PEOs. The successful achievement of the PEOs has a bearing on all the stakeholders. The primary constituents of the Mechanical Engineering Program are as follows:
The Secondary Constituents are:
- Faculty
- Industry
- Alumni

The secondary constituent for the Mechanical Engineering Program includes the Student Advisory Board whose representatives are from student organizations as well as other students.

B.2.3 Process of Establishing Program Educational Objectives

![Diagram of Program Educational Objectives](image)

**Primary Constituents:**
- Alumni
- Industrial Advisory Board
- Faculty

**Secondary Constituent:**
- Students/Student Advisory Board

**Program Objective and Outcome Assessment Tools**

**Fast Loop**

**Curriculum and Course Modifications by Faculty**

**Slow Loop**

**Program Outcome assessment tools**
- Alumni
- Senior Exit Interview by Industry Advisory Board Exit Interview
- Senior Student Exit Survey
- FE Exam
- Comprehensive Exit Exam
- Faculty Input
- Prerequisite Exams

**Figure B.2.1. Assessment of Program Educational Objectives.**
B.3 Program Outcomes and Assessment

B.3.1 Program Outcomes

The outcomes for the WSU Mechanical Engineering Program were taken directly from the ABET Program Outcomes required to satisfy the ME Program. Criterion 3 presents the eleven general Mechanical Engineering Program Outcomes for engineering graduates.

The WSU Mechanical Engineering Program requires students to attain:

(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\(^1\)
(d) An ability to function on a multidisciplinary team.
(e) An ability to identify, formulate, and solve engineering problems.
(f) 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 and social 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.

\(^1\) Outcome (c) for the new PEO—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).
### Spring 2007 Senior Exit Survey on Classes
(5 = excellent—1 = poor)

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Amount of Learning</th>
<th>Quality of Instruction</th>
<th>Workload</th>
<th>Course Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 223 Statics</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>AE 333 Mechanics of Materials</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
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<th>Amount of Learning</th>
<th>Quality of Instruction</th>
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<th>Course Value</th>
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Figure B.3.2. Spring 2007 Senior Exit Survey, Section A.
Spring 2007 Senior Exit Survey

The Mechanical Engineering Program is undergoing continuous change to better meet the needs of students and the employers who hire graduates. This questionnaire is one of the methods we use to gather information about our program. Please answer the following questions as honestly as you can. Please DO NOT include your name or any identifying information.

1. Please answer the following and provide your comments.
   - Professional communications skills were emphasized.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - Team work skills were emphasized.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - N/A computer technologies were extensively used in the classroom.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - Ethics was emphasized in several courses in the program.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A

   Comments:

2. Laboratories are designed to help students understand the principles of engineering science courses, learn how to collect engineering data, and give hands-on experience with engineering equipment. Please state your laboratory experience in terms of these objectives.
   - Laboratory class lectures explained theory adequately.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - Laboratory class lectures covered safety issues.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - The laboratory assistants were helpful.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - Computer technologies, including software, were extensively used in the classroom.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A

   Comments:

3. Please give your views on student advising on academic and professional issues provided by mechanical engineering faculty.
   - Overall, ME faculty advising and guidance on academics/career was helpful
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - Overall, the faculty had expertise in various fields within M.E.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A

   Comments:

4. Do you believe that the ME curriculum has prepared you for engineering practice in the real world?
   - The program allowed you to practice engineering science fundamentals in the solution of real problems.
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - How actively did you participate in professional activities ASME, SAE, Mini-Baja, SAE Formula Car, or other activities?
     - [ ] Very Active [ ] Active [ ] Participated [ ] Occasionally Participated [ ] Did Not Participate

   Comments:

5. Do you feel that your co-operative work experience has been a useful supplement to your classroom engineering education? Please feel free to comment.
   - I have had co-op experience during my program
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - I have current or previous engineering work experience
     - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A
   - IF you are a transfer student, how would you consider your background with that of your classmates at the BEGINNING of your ME program?
     - [ ] superior [ ] much better [ ] somewhat less [ ] was harder [ ] don’t know

   Comments:

6. If you are a transfer student, do you agree that your competency level is similar to other students in your senior classes?
   - [ ] Strongly Agree [ ] Agree [ ] Neutral [ ] Disagree [ ] Strongly Disagree [ ] N/A

7. Other comments.

Figure B.3.3. Spring 2007 Senior Exit Survey, Section B.
Spring 2007 Senior Exit Survey Suggestions for Improvement

Please offer constructive criticism of the Mechanical Engineering Program and departmental services and faculty—your most favorite instructor/subject. Offer suggestions for improvement of areas in which the program is weak, and be sure to tell us about areas where the program is strong. Please feel free to attach additional sheets for comments.

1. Which mechanical engineering required course(s) helped you raise your skills and knowledge? Please elaborate.

2. Which mechanical engineering elective course(s) helped you learn practical and real-life skills? Please elaborate.

3. Which of the mechanical engineering course(s) need changes? Please elaborate.

4. Upon graduation, do you plan to work or go to graduate school?

5. Please give scores for the following ABET evaluation outcomes: Poor (1) to Excellent (5)

   (a) Ability to apply knowledge of mathematics, science, and engineering. (   )

   (b) Ability to design and conduct experiments, as well as to analyze and interpret data. (   )

   (c) Ability to design a system, component or process to meet desired needs (   )

   (d) Ability to function on a multi-disciplinary team. (   )

   (e) Ability to identify, formulate, and solve engineering problem. (   )

   (f) Understanding of professional and ethical responsibility. (   )

   (g) Ability to communicate effectively. (   )

   (h) Broad education necessary to understand the impact of engineering solutions in a global and social context. (   )

   (i) Recognition of the need for, and an ability to engage in life-long learning. (   )

   (j) Knowledge of contemporary issues. (   )

   (k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice. (   )

Figure B.3.4. Spring 2007 Senior Exit Survey, Section C.
**Senior Exit Interview with Industry Advisory Board**

1. Have you had any cooperative education or any industry experience?

2. What are your short-term goals? Long-term goals?

3. Are you planning to go to graduate school? If yes, what area?
   a. Engineering (area: ____________) b. Management c. Other _____________

4. In what kind of job or industry field would you like to work?

5. On a scale of 1 (low) to 5 (excellent), what is your overall rating of the WSU ME Program in preparing you for engineering practice or further study? ________
   What are your suggestions for further strengthening the program?

6. Did you take classes outside WSU as part of your coursework for your ME degree? If yes, were the courses deficient in any way?

7. What is your opinion about facilities, including library, labs, and computational facilities?

8. On a scale of 1 (low) to 5 (excellent), what is your overall rating of the WSU ME faculty in terms of quality, knowledge, and expertise? ________

9. Other suggestions (use back of form as needed):

---

Figure B.3.5. Senior Exit Interview with Industry Advisory Board.

**B.3.2 Engineer of 2020 Initiative at the College Level**

The College of Engineering at Wichita State University has launched a strategic initiative, *Engineer of 2020*, in order to prepare graduates for effective engagement in the engineering profession in the year 2020. This initiative is, in part, motivated by two reports from the National Academy of Engineering, of the National Academies, entitled *The Engineer of 2020* and its follow-up initiative *Educating the Engineer of 2020*. In addition, the college’s Industry Advisory Board has raised the same issues that were addressed by these reports.

In response to this challenge, the CoE developed, through a faculty taskforce, a proposal that was eventually approved by college faculty in spring 2007. The adopted proposal requires that each student fulfilling the requirements for an engineering B.S. degree at WSU will complete the program course requirements, including at least **three** of the following six activities:

1. Undergraduate Research
2. Cooperative Education or Internship
3. Global Learning or Study Abroad
4. Service Learning
5. Leadership  
6. Multidisciplinary Education

This initiative will be effective for those choosing engineering as a major starting in fall 2007.

**Undergraduate Research**

Students will work under the supervision of a faculty member, either as an undergraduate research assistant for one semester, or performing independent study. The faculty supervising the undergraduate research approves the activity and signs the form.

**Cooperative Education/Internship**

Students will work 40 hours per week for two semesters or 20 hours per week for four semesters. Students may intern or have other work experience to meet this requirement. The activity is evaluated by the department and the department co-op coordinator signs the form.

**Global Learning/Study Abroad**

Students will participate in a global learning project within a class at WSU or complete credit-bearing classes in a foreign country. The faculty teaching the global learning class or the Office of International Programs approves the activity and signs the form.

**Service Learning**

Students will participate in a project in a credit-bearing class that serves the community’s needs as part of the engineer’s responsibility to society. The faculty supervising the service learning approves the activity and signs the form.

**Leadership**

Students will participate in formal instruction of peers and lead a project or have previous leadership experience. The student completes a project report and submits to the Director of Engineering Education.

**Multidisciplinary Education**

Students will obtain a minor or second major outside their engineering discipline. Students submit a form to the Director of Engineering Education documenting completion of this criterion.

This strategic initiative also takes advantage of the flexibility of the Engineering Criteria 2000 (EC 2000) of the Accreditation Board for Engineering and Technology and helps the department satisfy the criteria and spirit of ABET EC 2000. The criteria that each activity may satisfy are shown in Table.B.3.37.
Table B.3.37. Mapping of Engineer of 2020 Initiative with ABET Criterion 3

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<th>Engineer of 2020 Experience</th>
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<th>(c)</th>
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B.4 Internships and Co-op Education

Most mechanical engineering students work in local industries by the time they reach their junior year. In addition, students use the services of the Office of Cooperative Education to seek suitable internship positions. Although the program does not give credit for co-op and industry experience, the wide experience of its student body brings a higher level of understanding regarding societal, ethical, legal, and global issues to the mechanical engineering practice.

The close proximity of WSU to related industry offers a great opportunity for students to gain practical experience and apply the knowledge they acquire while they are enrolled in the program. Students opt for co-op education and summer internship through employment in local industries. The largest employers for engineering students are: Raytheon, Engenio, Cessna, Bombardier Learjet, Spirit AeroSystems, Cargill, and Electromech Technologies. The chart below outlines enrollment for the most recent five fall semesters.

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</table>

In 2006 the number of placements in mechanical engineering increased by 6 (38 percent) in comparison to fall 2005. Students gain experience in a variety of areas that directly is related to the Outcomes (a) through (k), which were discussed earlier.

B.4.1 Campus Work Opportunities

Much of the mechanical engineering student body works in local industries, which follow a flexible policy toward student class schedules. The co-op office offers them any help they need or seek. Additionally, engineering work opportunities are available in the laboratories of the National Institution for Aviation Research, which employs mechanical engineering students to design, fabricate, and analyze experimental data for its research projects. The physical plant and computer centers in various colleges across WSU also offer opportunities for the Mechanical Engineering Program students. These opportunities cover a wide range of fields, primarily pertaining to the local aircraft manufacturing industry.

B.4.2 Activities with Professional Organizations
The Department of Mechanical Engineering has initiated Formula SAE and Baja SAE programs and participated in national competitions beginning in AY 2006. Funding for these programs was provided by various sources, including the student government body and College of Engineering. Also, the department has worked on a collaborative agreement with the Wichita Area Technical College for using its laboratories—electronic, testing, and fabrication facilities—for the Formula SAE and Baja SAE programs, and several design courses, including Design of HVAC Systems.

Mechanical engineering students participate in the student chapters of ASME, ASHRAE, SAE, Pi Tau Sigma, and Tau Beta Pi. The WSU section of the American Society of Mechanical Engineers participates in regional and national student competitions, presenting papers and entering design competitions. Details of WSU’s participation in the last three years are shown in Table B.4.6.

Table B.4.6. Participation in ASME Student Activities

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<th>Student</th>
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<td>ASME Design Contest</td>
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<td>2003</td>
<td>Old Guard Poster Competition</td>
<td>Robert Rankin</td>
</tr>
<tr>
<td>2003</td>
<td>Old Guard Poster Competition</td>
<td>Harry Grilliot</td>
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<td>2004</td>
<td>Old Guard Poster Competition</td>
<td>Tony den Hoed</td>
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<td>David Lenhert</td>
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<td>Julia Hanks</td>
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<td>Tim Welch, Scott Hamilton, and Seth Winzer</td>
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<td>ASME Arthur L. Williston Award Contest</td>
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<td>2005</td>
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<td>Chris Aberle, Aron Conley, Lisa Reuter, and Daniel Stuchlik</td>
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<td>Old Guard Poster Competition</td>
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<td>2006</td>
<td>Old Guard Poster Competition</td>
<td>Sean Killingsworth</td>
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B.5 Faculty

- **Dr. Ikram Ahmed**, Assistant Professor, Ph.D. (University of Texas at Austin, 1997)
  
  **Subject Areas of Interest:** Fluid Mechanics, Heat Transfer, and Thermodynamics  

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<td>ME 650P</td>
<td>Selected Topics in ME—Computational Thermo-Fluid Systems</td>
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<td>ME 750P</td>
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</table>

- **Dr. Ramazan Asmatulu**, Assistant Professor, Ph.D. (Virginia Tech, 2004)
  
  **Subject Areas of Interest:** Nanotechnology and Bionanotechnology  
  **Research Areas of Interest:** Materials Science, Nanotechnology (synthesis and characterization of magnetic and conductive nanoparticles, nanofilms, nanowires and nanocomposites), Bionanotechnology, Colloidal Photonic Crystals, Corrosion, Filtration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 251</td>
<td>Materials Engineering Laboratory</td>
</tr>
<tr>
<td>ME 760</td>
<td>Fracture Mechanics</td>
</tr>
<tr>
<td>ME 850N</td>
<td>Nanomaterials Fabrication and Characterization</td>
</tr>
<tr>
<td>ME 850J</td>
<td>Corrosion</td>
</tr>
</tbody>
</table>

- **Dr. Behnam Bahr**, Professor, Ph.D. (University of Wisconsin-Madison, 1988)
  
  **Subject Areas of Interest:** Robotics, Automation, and Computer-Aided Engineering  
  **Research Areas of Interest:** Robotics and Control of Material Processing, Design of Haptic and Medical Devices, Advanced CAD/CAM, Drilling Processes

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 325</td>
<td>Computer Applications</td>
</tr>
<tr>
<td>ME 450</td>
<td>Selected Topics—Creative Design and Practice</td>
</tr>
<tr>
<td>ME 637</td>
<td>Computer-Aided Engineering</td>
</tr>
<tr>
<td>ME 737</td>
<td>Robotics and Control</td>
</tr>
<tr>
<td>ME 747</td>
<td>Microcomputer-Based Mechanical Systems</td>
</tr>
</tbody>
</table>

- **Dr. Brian Driessen**, Assistant Professor, Ph.D. (Georgia Tech, 1996)
  
  **Subject Areas of Interest:** Automation and Control Systems  
  **Research Areas of Interest:** Dynamics, Controls Modeling, Optimization, Scalability, Robustness Aspects of Control Implementation

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 533</td>
<td>Mechanical Engineering Laboratory</td>
</tr>
<tr>
<td>ME 659</td>
<td>Mechanical Control Systems</td>
</tr>
<tr>
<td>ME 758</td>
<td>Non-Linear Controls of Electro-Mechanical Systems</td>
</tr>
</tbody>
</table>

- **Dr. David N. Koert**, Associate Professor, Ph.D. (Drexel, 1990)
**Subject Areas of Interest:** Thermodynamics, Combustion and Fluid Mechanics

**Research Areas of Interest:** Fuel Tank Safety, Combustion and Combustion Chemistry, Alternative Fuels, Flammability of Materials, Air Pollution Control

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 398</td>
<td>Thermodynamics I</td>
</tr>
<tr>
<td>ME 469</td>
<td>Energy Conversion</td>
</tr>
<tr>
<td>ME 633</td>
<td>Mechanical Engineering Systems Laboratory</td>
</tr>
<tr>
<td>ME 719</td>
<td>Basic Combustion Theory</td>
</tr>
</tbody>
</table>

- **Dr. Hamid M. Lankarani,** Professor, Ph.D. (University of Arizona, 1988)
  **Subject Areas of Interest:** Design Mechanical Systems and Dynamics
  **Research Areas of Interest:** Mechanical Engineering Design, Impact Dynamics, Crashworthiness, Multibody Dynamics, Structures, Biomechanics, Occupant Protection

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 339</td>
<td>Design of Machinery</td>
</tr>
<tr>
<td>ME 729</td>
<td>Computer-Aided Analysis of Mechanical Systems</td>
</tr>
</tbody>
</table>

- **Dr. Bob Minaie,** Associate Professor, Ph.D. (University of Minnesota, 1988)
  **Subject Areas of Interest:** Design and Dynamics
  **Research Areas of Interest:** Computational and Experimental Research in Polymer Composites, Nanocomposites, and Functionally Graded Hybrid Composites Using Intelligent Process Design, Optimization, Characterization, Control, Sensors

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 439</td>
<td>Mechanical Engineering Design I</td>
</tr>
<tr>
<td>ME 541</td>
<td>Mechanical Engineering Design II</td>
</tr>
<tr>
<td>ME 639</td>
<td>Applications of Finite Element Methods in Mechanical Engineering</td>
</tr>
<tr>
<td>ME 762</td>
<td>Polymeric Composite Materials</td>
</tr>
</tbody>
</table>

- **Dr. T. S. Ravigururajan,** Associate Professor, Ph.D. (Iowa State University, 1986)
  **Subject Areas of Interest:** Heat Transfer, Thermodynamics, and Computer Languages
  **Research Areas of Interest:** Thermal Management in Material Processing, including Laser Cutting/Welding and Friction Stir Welding, Application of Novel Heat Transfer Enhancement Techniques to Cutting Tool Design, Bio-MEMS, Biomedical Modeling

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 502</td>
<td>Thermodynamics II</td>
</tr>
<tr>
<td>ME 522</td>
<td>Heat Transfer</td>
</tr>
<tr>
<td>ME 544</td>
<td>Design of HVAC Systems</td>
</tr>
<tr>
<td>ME 631</td>
<td>Heat Exchanger Design</td>
</tr>
</tbody>
</table>

- **Dr. Dennis Siginer,** Professor, Ph.D., D.Sc. (University of Minnesota, 1983)
  **Subject Areas of Interest:** Fluid Mechanics, Non-Newtonian Fluids, Rheology of Bio-Fluids
  **Research Areas of Interest:** Continuum Mechanics, Transport Phenomena in Materials Processing, Fluid Mechanics, Non-Newtonian Fluid Mechanics, Rheology, Heat Transfer with Non-Newtonian and Viscoelastic Liquids, Fluid Mechanics in Microgravity, Fluid
Mechanics of Biological Systems

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 521</td>
<td>Fluid Mechanics</td>
</tr>
<tr>
<td>ME 522</td>
<td>Heat Transfer</td>
</tr>
<tr>
<td>ME 650A</td>
<td>Selected Topics—Introduction to Bio-Fluids</td>
</tr>
</tbody>
</table>

- **Dr. Kurt Soschinske**, Assistant Professor, Ph.D. (Wichita State University, 1997)
  Subject Areas of Interest: Capstone Design, Mechanical Measurements and Acoustics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 533</td>
<td>Mechanical Engineering Laboratory</td>
</tr>
<tr>
<td>ME 662</td>
<td>Mechanical Engineering Practice</td>
</tr>
<tr>
<td>ME 669</td>
<td>Acoustics</td>
</tr>
</tbody>
</table>

- **Dr. George E. Talia**, Professor, Ph.D. (Case Western Reserve, 1984).
  Subject Areas of Interest: Materials
  Research Areas of Interest: Materials Sciences, Mechanical Properties of Materials, Microscopy, Defects in Materials, Friction Stir Welding, Composite Materials

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 250</td>
<td>Materials Engineering</td>
</tr>
<tr>
<td>ME 664</td>
<td>Introduction to Fatigue and Fracture</td>
</tr>
<tr>
<td>ME 665</td>
<td>Selection of Materials</td>
</tr>
<tr>
<td>ME 667</td>
<td>Mechanical Properties of Materials I</td>
</tr>
</tbody>
</table>

**B.5.1 Student-Faculty Interaction**

Faculty members interact with students as advisors to student organizations, which interact with local chapters of the national organizations. Faculty members are active in college and university recruiting. Faculty members routinely attend student chapter meetings of professional societies. The department holds a holiday reception in December and a graduation reception in May and December. During this time, members of the Industrial Advisory Board and faculty mingle with students. The department also hosts a party for incoming new students every fall semester with pizza and a roundtable discussion.

**B.5.2 Student Advising and Counseling**

The Department of Mechanical Engineering takes the advising process seriously, believing it should be an effective interaction between students and faculty members, and oriented toward monitoring progress and making appropriate decisions. Each faculty is in charge of advising approximately 30 students. The faculty member acts as a “go-to” person and a mentor. Apart from traditional course advising, students are strongly encouraged to discuss career plans, internship opportunities, graduate studies, and any professional shortcomings they may have with regard to their educational experience. Although faculty members have
scheduled office hours posted outside their offices, it is recommended that students arrange appointments to see their advisors outside of regular office hours. Steps in the mechanical engineering advising process were discussed in section B.1.2.

**New and Transfer Student Advising**

The Department of Mechanical Engineering recognized the need for, and appointed a faculty member to be, the undergraduate coordinator. The coordinator advises incoming freshmen and transfer students in first-semester courses. During the first semester, each student admitted to the Mechanical Engineering Program is assigned a faculty member as a one-on-one advisor. Normally, students will have the same advisors until they graduate. The objective is to foster an ongoing relationship between students and faculty members and thus for faculty members to develop an understanding of the unique needs of their advisees.

**B.5.3 Service**

Service in the ME department as well as universitywide is recognized as one of the three primary responsibilities of faculty members. The yearly professional goals of each faculty member include a component of service, as well as components of teaching and scholarly activity. The percentage of time that each faculty member devotes to service varies with the individual (in a typical year, ranging from 5 to 25 percent).

Service encompasses activities that range from departmental administrative duties to activities that serve the mechanical engineering profession or even the engineering education profession as a whole, such as appointments to national committees of the American Society of Mechanical Engineers. The following excerpt from WSU’s College of Engineering “Faculty Activity Record,” shows the suggested categories of service that faculty members report:

**Service Criteria**

- Any offices and special appointments in local, regional, and national professional organizations.
- Professional consulting and service, including reviewing/editing for journal/conference papers, grant proposals, and book manuscripts; organizing conferences, sessions in conferences; offering professional/continuing education workshop/seminars; advising student organizations.
- Administrative (including graduate assistant supervision, etc.), committee activity, or other service within the department, the college and the university.
- Community service and special services to WSU.
- Special awards, honors, or other recognition of excellence in service.

Using these categories as guidelines, the following tables present some examples of the mechanical engineering faculty's involvement in service areas (Tables B.5.1 to B.5.4).
<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ramazan Asmatulu</td>
<td>Active member, Materials Research Society (MRS), 2001–present</td>
</tr>
<tr>
<td>Dr. Behnam Bahr</td>
<td>Member, Composites Aircraft Composite Repair Committee, 1995–present</td>
</tr>
<tr>
<td>Dr. Hamid Lankarani</td>
<td>Executive member, ASME Technical Committee on Multibody Systems and Nonlinear Dynamics, 2003–present; contributing member, SAE Aircraft Seat Committee, 1996–present</td>
</tr>
<tr>
<td>Dr. Bob Minaie</td>
<td>Technical session organizer, SAE 2006 General Aviation Technology Conference</td>
</tr>
<tr>
<td>Dr. T. S. Ravigururajan</td>
<td>Member, ASME National K-10 and K-19 Committee, 1989–present; chair, ASME National K-10 Committee</td>
</tr>
</tbody>
</table>
Table B.5.2. Faculty Service—Professional Consulting and Service*

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ramazan Asmatulu</td>
<td>Reviewer, paper for Surface and Coating Technologies; presenter on Nanotechnology and Bionanotechnology, College of Engineering</td>
</tr>
<tr>
<td>Dr. Behnam Bahr</td>
<td>Reviewer, papers for ASME <em>Transactions Journal of Mechanical Design</em>, 2000–present</td>
</tr>
<tr>
<td>Dr. Brian Driessen</td>
<td>Reviewer, several (10) journals and conferences (about 4)</td>
</tr>
<tr>
<td>Dr. David Koert</td>
<td>Faculty Advisor, Tau Beta Pi, 1994–present; faculty advisor, WSU Student Section of SAE, 1998–present; faculty advisor, Baja SAE team, 2004–present; faculty advisor, Formula SAE team, 2006–present</td>
</tr>
<tr>
<td>Dr. Bob Minaie</td>
<td>Reviewer of papers for <em>Journal of Composite Materials</em> and <em>Journal of Porous Media</em></td>
</tr>
<tr>
<td>Dr. T. S. Ravigururajan</td>
<td>Organizer and chair, sessions on Heat Transfer Enhancement at the ASME International Conferences, Orlando (2003) and San Francisco (2005), and IMECE 2006</td>
</tr>
<tr>
<td>Dr. Dennis Siginer</td>
<td>Associate Editor and Guest Editor, special issues of <em>Journal of Fluids Engineering</em>, 2003–present; Associate Editor and Guest Editor, special issues of <em>Journal of Applied Mechanics</em> 1997–present; reviewer, numerous professional journals and several granting agencies in the U.S., Canada, and Chile; organizer, numerous symposia for ASME meetings; member, organizing committees of several international conferences and numerous seminars in the U.S. and abroad</td>
</tr>
</tbody>
</table>

*includes reviewing/editing journal/conference papers
<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ikram Ahmed</td>
<td>Teacher, EIT review sessions in Materials Science, 2005–present (college), University Committee, Graduate Coordinator, Graduate Council.</td>
</tr>
<tr>
<td>Dr. Ramazan Asmatulu</td>
<td>Member, Laboratory Committee; member, CoE Research Initiative Committee</td>
</tr>
<tr>
<td>Dr. Behnam Bahr</td>
<td>Chair, Department of Mechanical Engineering, 2005–present; member, Faculty Senate Affairs, 2005; member, University Research Council</td>
</tr>
<tr>
<td>Dr. B. Driessen</td>
<td>Member, CoE Research Initiative Committee; member, Faculty Senate; member, ME ABET Committee; member, ME Curriculum Committee; member, College of Engineering Bio Initiative Taskforce; member, College of Engineering Systems Engineering Focus Group Committee; member, ME Laboratory Committee; judge, posters at Graduate Research and Scholarly Projects Symposium (GRASP) and National Science Olympiad, Wichita State University</td>
</tr>
<tr>
<td>Dr. David Koert</td>
<td>Associate Dean for Research and Information Technology, 2002–03; chair, College LAN Committee, 2001–06; member, College Space and Facilities Committee, 2005–present; member, T and P Committee, 2004–06 (university)</td>
</tr>
<tr>
<td>Dr. Hamid Lankarani</td>
<td>Member, Engineering Dean Search Committee 1999–2000 (college); member, University Assessment Committee; member, Doctoral Sub-Council; and member, Faculty Grievance Committee</td>
</tr>
<tr>
<td>Dr. Bob Minaie</td>
<td>Member, Mechanical Design Committee and CoE Dean’s Faculty Advisory Committee</td>
</tr>
<tr>
<td>Dr. T. S. Ravigururajan</td>
<td>Member, University Curriculum Committee 2005–present (university); member, Faculty Senate 1999–03</td>
</tr>
<tr>
<td>Dr. Dennis Siginer</td>
<td>Member, NIAR Director Search Committee 2001–03 (university); member, Faculty Senate 2006–present (university); member, Promotion and Tenure Committee 2006 (college); chair, Promotion and Tenure Committee Chair 2003–present (department); chair, Faculty Search Committee Chair 2005 (department)</td>
</tr>
<tr>
<td>Dr. K. Soschinske</td>
<td>Member, CoE 20/20 Vision Committee 2006 (college); member, Mechanical Design Committee 2006 (college); member, Laboratory Committee 2006 (college), member, ME Faculty Search Committee 2004–06 (department)</td>
</tr>
<tr>
<td>Dr. George Talia</td>
<td>Member, Mechanical Design Committee; member, department Curriculum Committee; member, ABET Committee</td>
</tr>
</tbody>
</table>
Table B.5.4. Faculty Service—Community Service and Special Services to WSU

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ramazan Asmatulu</td>
<td>Prepared one safety manual and two solution manuals for the department (could be used by the college as well); organized ME 251 Materials Engineering Laboratories</td>
</tr>
<tr>
<td>Dr. Behnam Bahr</td>
<td>Served on Advisory Board Committee for Wichita Area Technical College 2007; judged Robotics Contest, Butler State Fair 2006; judged high school debates 2005–06.</td>
</tr>
<tr>
<td>Dr. Brian Driessen</td>
<td>Attended National Science Olympiad meeting</td>
</tr>
<tr>
<td>Dr. David Koert</td>
<td>Attended NI Week ROBOLAB Workshop, Austin Convention Center, Austin, TX, August 16–18, 2004</td>
</tr>
<tr>
<td>Dr. Hamid Lankarani</td>
<td>Hosted visiting foreign students and faculty; hosted NIAR Faculty Fellows Workshops</td>
</tr>
<tr>
<td>Dr. Bob Minaie</td>
<td>Chaired technical session on Composite Materials Processing for SAE 2006 General Aviation Technology Conference</td>
</tr>
<tr>
<td>Dr. T. S. Ravigururajan</td>
<td>Evaluated Undergraduate Distinguished Scholarship Invitational, 2004; judged Senior Design contest, North East Magnet High School</td>
</tr>
<tr>
<td>Dr. Kurt Soschinske</td>
<td>Evaluated Undergraduate Student Recruitment Wallace Scholar Invitational; served on Advisory Board Committee; served on WATC 2005–present.</td>
</tr>
</tbody>
</table>

B.5.4 Professional Development

Table B.5.5. Typical Faculty Professional Development Activities

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Professional Development Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ramazan Asmatulu</td>
<td>Attended ABET meetings</td>
</tr>
<tr>
<td>Dr. Behnam Bahr</td>
<td>Attended ASME department head meeting for ABET, 2006 and 2007</td>
</tr>
<tr>
<td>Dr. B. Driessen</td>
<td>Attended teaching effectiveness workshops and grant-writing workshops</td>
</tr>
<tr>
<td>Dr. Hamid Lankarani</td>
<td>Served as active contributing member of the national standards and rule-making SAE seat committee</td>
</tr>
<tr>
<td>Dr. Bob Minaie</td>
<td>Attended AFOSR technical meetings and SAMPE technical conferences</td>
</tr>
<tr>
<td>Dr. T. S. Ravigururajan</td>
<td>Took five courses in Bioengineering/BioMed related areas; attended ABET Workshop, 2006</td>
</tr>
<tr>
<td>Dr. Kurt Soschinske</td>
<td>Took graduate acoustics courses at Penn State University, summers 1999–04; attended Strain Gage Installation Seminar, Vishay Micrometres, Wichita, June 2006</td>
</tr>
<tr>
<td>Dr. Dennis Siginer</td>
<td>Attended ASME Leadership Training Conference, 2006</td>
</tr>
</tbody>
</table>

B.5.5 Interactions with Industry

Table B.5.6. Faculty Interaction with Industry Through Research/Projects/Teaching

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Interaction with Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ikram Ahmed</td>
<td>Met with technical advisors from industry for the ADMRC research</td>
</tr>
<tr>
<td>Faculty Member</td>
<td>Interaction with Industry</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Dr. Ramazan Asmatulu</td>
<td>Met several times with local aircraft industries on acoustics and corrosion (one ADMRC proposal is funded on acoustics)</td>
</tr>
<tr>
<td>Dr. Behnam Bahr</td>
<td>Met with technical advisors from industry for the ADMRC research project</td>
</tr>
<tr>
<td>Dr. B. Driessen</td>
<td>Met several times with the NIS/FAA Friction Stir Welding Industrial Board and the NSF Friction Stir Welding Center Industrial Board members; met with ADMRC industrial members of the project group on drilling of composites.</td>
</tr>
<tr>
<td>Dr. David Koert</td>
<td>Formed exploratory group on flammability of materials in 2006, an NIS-funded project that included Boeing, Cessna, and Raytheon as industry collaborators</td>
</tr>
<tr>
<td>Dr. Hamid Lankarani</td>
<td>Organized workshops with automotive and aircraft industry participation; conducted research projects on crashworthiness funded by industry</td>
</tr>
<tr>
<td>Dr. Bob Minaie</td>
<td>Interacted with engineers from Spirit AeroSystems, Raytheon Aircraft, Cessna, Boeing on various projects</td>
</tr>
<tr>
<td>Dr. Kurt Soschinske</td>
<td>Met regularly with technical advisors from industry for the research project.</td>
</tr>
</tbody>
</table>
### Table B.5.7. Special Awards, Honors, or Other Recognition of Excellence in Service

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Recognition of Excellence in Service</th>
</tr>
</thead>
</table>
| Dr. Ramazan Asmatulu | Outstanding Graduate Student Award, Virginia Tech, 2001  
NATO Graduate Student Scholarship to Study at Virginia Tech, 1997  
Outstanding Teaching and Research Assistant, Istanbul University, 1996 |
| Dr. Behnam Bahr      | Recipient, Polished Professor Award, College of Engineering, 2001, 2002, 2005  
Nominee, Effective Teaching Award, Board of Trustees Excellence in Teaching and the Academy, 2001, 2005  
Fellow, Boeing Company, 2002–04 |
| Dr. David Koert      | Recipient, Polished Professor Award, College of Engineering, 2007 |
| Dr. Hamid Lankarani  | Recipient, Excellence in Research Award, Wichita State University, 2007  
Recipient, Dwane and Velma Wallace Outstanding Educator Award for Excellence in Teaching, College of Engineering, 2005  
Elected Fellow, American Society of Mechanical Engineering, 2005  
Fellow, Boeing Company, 2005  
Senior Fellow, National Institute for Aviation Research, elected 2001  
Recipient, Academy for Effective Teaching Award, Wichita State University 2001  
Recipient, Polished Professor Award, College of Engineering, 1992, 2004, 2006  
Associate Technical Editor, ASME *Journal of Computational and Nonlinear Dynamics*, 2004–present  
Associate Technical Editor, ASME *Journal of Medical Devices*, 2006–present  
Member, Editorial Board for the *International Journal of Multibody Systems Dynamics*  
Executive Member, ASME Technical Committee on Multibody Systems and Nonlinear Dynamics, 2003–present |
| Dr. Bob Minaie       | Fellow, Boeing Company, 2006  
Chair, Society of American Engineers, Composite Processing, 2006 |
| Dr. Dennis Siginer   | ABET Program Evaluator, 2006–present  
Fellow, AAM, elected 2006  
Advisor, Board of Governors “Ecole Centrale de Lyon” Lyon, France, 2006–present  
Member, Board of Directors of SES, 2006–present  
Member, Executive Committee, ASME Materials Division 2005–present  
Associate and Guest Editor, *Journal of Applied Mechanics*, 1997–present  
Associate and Guest Editor, *Journal of Fluids Engineering*, 2003–present  
Member, Permanent Executive Committee, ICTEA, 2004–present  
Member, Advisory Board, NASA-NSF Center on Information Systems Engineering and Management, 2004–present |
<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Recognition of Excellence in Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Member, Advisory Board, ASME Fluids Engineering Division, 2003–present</td>
</tr>
<tr>
<td></td>
<td>Member, Advisory Board, Florida International University, 2004–present</td>
</tr>
<tr>
<td></td>
<td>Member, International Advisory Board, Fourth Pacific Rim Conference on Rheology, Shanghai, China, 2004–05</td>
</tr>
<tr>
<td></td>
<td>Fellow, NYAS, elected 2002</td>
</tr>
<tr>
<td></td>
<td>Member, International Steering Committee, ICTEA, 2003–present</td>
</tr>
<tr>
<td></td>
<td>Plenary lecturer, China (2005), Lebanon (2004), UAE (2006), Jordan (2007), and lecturer in numerous invited seminars in the U.S. and abroad in France, Chile, Brazil</td>
</tr>
<tr>
<td></td>
<td>Visiting Professor, Ecole Centrale de Lyon and Université Claude Bernard, Lyon, France, June–July 2006</td>
</tr>
<tr>
<td></td>
<td>Visiting Professor, Universidad de Santiago de Chile, Santiago, Chile, December 2005–January 2006</td>
</tr>
<tr>
<td></td>
<td>Visiting Professor, Ecole Polytechnique de l’Université de Nantes, Nantes, France, May–August 2005</td>
</tr>
<tr>
<td>Dr. George Talia</td>
<td>Fellow, Learjet/Bombardier, 2001–03</td>
</tr>
</tbody>
</table>
B.6 Facilities

This section of the report describes classrooms, laboratory facilities, equipment, and infrastructure, and discusses the adequacy of these facilities to accomplish program objectives, as required by Criterion 6.

B.6.1 Classrooms

Most mechanical engineering classes are held in the classrooms located in the Engineering Building (EB). The capacity of these classrooms ranges from 35 to 50 students. Also, an auditorium in Wallace Hall (WH) is available for large classes. These classrooms are adequate for teaching the courses. Each classroom contains an overhead projector, Internet access, and an LCD projector. The Department of Mechanical Engineering also owns additional portable LCD projectors, a TV, a VCR, a laptop computer, and video cameras and digital cameras for videotaping oral presentations and project recording.

B.6.2 Laboratories

Mechanical Engineering Laboratory Curriculum

The objectives of the mechanical engineering laboratory curriculum are as follows:

- To reinforce and exercise engineering and measurement principles, exposure to instrumentation and systems, and engineering practice.
- To train in test techniques.
- To develop creative thinking and diagnostic skills.
- To develop proficiency in data analysis and presentation.
- To provide a platform for practice in technical communication.

Courses with Significant Laboratory Content

Undergraduate students pursuing a mechanical engineering degree are required to complete successfully the following laboratory courses:

- ME 251 Materials Engineering Laboratory (1 credit)
- ME 533 Mechanical Engineering Laboratory (3 credit)
- ME 633 Mechanical Engineering Systems Laboratory (3 credit)

In addition to the required laboratory courses, the Department of Mechanical Engineering offers upper-level laboratory classes (ME 637 Computer-Aided Engineering, ME 639 Applications of Finite Element Methods in Mechanical Engineering, ME 737 Robotics and Control, and ME 747 Microcomputer-Based Mechanical Systems). A new course (ME 450 Selected Topics in Mechanical Engineering—Creative Design and Practice) was designed and offered in spring 2007 to give junior students hands-on experience with manufacturing processes. Summary information for these courses is provided below. Additionally, some traditional courses (ME 502 Thermodynamics II, ME 521 Fluid Mechanics, ME 522 Heat Transfer, and ME 662 Mechanical Engineering Practice) supplement instruction with facilities that are provided in laboratories.
• ME 450 Creative Design and Practice (3 credits). Laboratory education in metal cutting, welding, and composite fabrication is located in the Creative Design and Practice Laboratory (Wichita Area Technical Training Center).

• ME 637 Computer-Aided Engineering (3 credits). PCs in the Design Laboratory (EB 209) are used to run finite element and CAD-graphics software.

• ME 639 Applications of Finite Element Methods in Mechanical Engineering (3 credits). PCs in the Design Laboratory (EB 209) are used to run finite element and ANSYS software.

• ME 737 Robotics and Controls (3 credits). PCs and data acquisition hardware and LabVIEW software in the Robotics and Controls Laboratory (WH 116) are used to complete projects.

• ME 747 Microcomputer-Based Mechanical Systems (3 credits). PCs and data acquisition hardware and LabVIEW software in the Robotics and Controls Laboratory (WH 116) are used to complete laboratory exercises and projects.

Each course in the curriculum has been designed to incorporate the performance of laboratory experiments that require the use of facilities provided by the Department of Mechanical Engineering.

**Mechanical Engineering Laboratories**

Facilities for the undergraduate laboratories are located in several rooms in Wallace Hall. The following is a list of rooms and a brief description of equipment in each room:

• **WH 07B Design Laboratory.** This laboratory is provided primarily for seniors to have access to an office environment to conduct work for the capstone design course (ME 662). This room is equipped with PCs, a telephone, a FAX machine, a conference table, and a limited library of catalogues. The 15 PCs in this room are also available for students in upper-level courses (e.g., ME 639 Applications of Finite Element Methods in Mechanical Engineering) who need access to specialized software (i.e., ALGOR, ProE, Fluent, etc.) for academic purposes.

• **WH 109 Mechanical Measurements Laboratory.** This laboratory houses experimental facilities for ME 533 Mechanical Engineering Laboratory and ME 633 Mechanical Engineering Systems Laboratory, and provides classroom space for all lab sections (i.e., meetings outside of lecture) of these classes. The room also provides a work area for design activities for students in ME 662 Mechanical Engineering Practice and independent study projects. As with other ME department lab and office space, this room is used to showcase student projects for the Engineering Open House.

• **WH 114 Engineering Systems Laboratory.** This laboratory houses 12 workstations for training students in the use of LabVIEW software for data acquisition, and experimental facilities for ME 633 Mechanical Engineering Systems Laboratory. The room is also equipped with GBIC Internet facilities that integrate high-quality video, audio, and data collection equipment to provide online access to laboratory experiments.

• **WH 116 Robotics and Controls Laboratory.** This laboratory provides students with computer- and microprocessor-based controls facilities used for upper-level laboratory
courses (ME 737 Robotics and Control, ME 747 Microcomputer-Based Mechanical Systems, and ME 847 Applied Automation and Control Systems).

- **WH 117 Materials Testing Laboratory.** This laboratory houses testing equipment for ME 251 Materials Engineering Laboratory and provides classroom space for students working on related laboratory activities. The equipment includes a tension/compression machine, a Charpy test facility, facilities for fatigue and crack growth testing, and related equipment for sample preparation and examination.

- **WH 124 Engine and Vibrations Laboratory.** This laboratory contains a diesel engine dynamometer test stand for ME 633 Mechanical Engineering Systems Laboratory and MTS equipment for vibration (shake table) and acceleration (drop table) tests. This equipment also generates revenue from local industry. This room contains a large overhead storage area.

- **WH 223 Materials Science Laboratory.** This laboratory has polishing and cutting facilities used by ME 251 Materials Engineering Laboratory students, and graduate students and researchers in coursework and research in materials science. This room contains a fume hood used in various materials science sample preparation activities (and other applications involving the handling of volatile, flammable and toxic substances).

- **WATC Creative Design and Practice Laboratory.** This laboratory, which supports the new course, ME 450A Creative Design and Practice, is located at the Wichita Area Technical Center.

The college has four technicians, each responsible for a specific area of specialty. This provides the college with technicians capable of dealing with equipment of different types and helping students with the various laboratories. These personnel have offices and workshops in the general area of the Wallace Hall laboratories. They are trained in electronic repair and are competent in machining and other mechanical areas. This provides an ideal combination for development and maintenance of the combination of mechanical, electrical/electronic, and computer systems that are of interest to mechanical engineers.

Support for the development and maintenance of the instructional laboratories comes primarily from the Engineering Student Equipment Fee. The $14 per engineering credit hour fee generates approximately $200,000 per year, all of which is returned to the WSU College of Engineering and departments therein, with the total budget allocation shown in Table B.6.1. Due to reduced allocation during AY 2003–05, laboratory facilities lagged behind in necessary development. Subsequently, increased allocations were made during AY 2006 and AY 2007, which have been utilized in revamping experiments and upgrading instrumentation.
Table B.6.1. Laboratory Funding for the Program

<table>
<thead>
<tr>
<th>Department</th>
<th>Student Fee Money Automatically Allocated to Departments</th>
<th>Teaching Labs Allocation</th>
<th>Grand Total</th>
</tr>
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<tbody>
<tr>
<td>CoE Total</td>
<td>$218,013.*</td>
<td>$220,000.</td>
<td>$438,013.</td>
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<td>ME 2006-2007</td>
<td>$31,389.</td>
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<td>$109,389.</td>
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<td>CoE Total</td>
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<td>$462,299.</td>
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<tr>
<td>CoE Total</td>
<td>$137,000.</td>
<td>$275,000.</td>
<td>$412,799.</td>
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</tbody>
</table>

*Includes a one-time $50,000 allocation from the President’s Office.
+Dean’s Office contributed $25,000 from other sources to this fund.

ME 251 Materials Engineering Laboratory

Purpose of Laboratory

This laboratory deals with an introductory course in materials engineering. In addition to demonstrating behavior of engineering materials and properties, this course is used to introduce students to a laboratory environment and familiarize them with formal engineering.

Equipment

The experiments and measurements in this laboratory are performed in two different areas: materials preparation and mechanical testing. Demonstrations are given in the Advanced Materials Laboratory. These laboratories are listed below, along with the basic items and equipment in each of them:

Materials Preparation Laboratory (WH 223)

- Diamond Saw
- Cut-Off Machines
- Stirrer/Hot Plates
- Grinder and Polishers
- Furnaces
- Metallurgical Microscopes
- Lab Ovens
- Ultrasonic Cleaners
• Digital Thermometers
• Cameras
• Inverted Optical Microscopes (for various uses, e.g., grain size and measurements)
• Balances

Mechanical Testing Laboratory (WH 117)

• Equipment for tension testing of metals and composites
• Equipment to measure fatigue strength of smooth and notched specimens
• Equipment that heat treats metals and analyzes the effect of heat on hardness and impact testing
• Equipment that measures room temperature creep
• Equipment that measures the ductile brittle transition temperature of ferrous alloys
• Equipment that provides polishing and a micro hardness test
• Cold Rolling Mill

Advanced Materials Laboratory (WH 223)

This laboratory facilitates some of the advance equipment used to support materials science experiments and capstone design projects:

• X-Ray Diffraction (XRD)
• Chemical Etching
• Four-Point Conductivity Measurement
• UV Spectroscopy
• Basic Microwave Optics System

In addition to these laboratories, a nanotechnology laboratory is being established in the CoE new engineering research building, which will house some of the equipment to be used for materials science. This equipment, belonging to the Department of Mechanical Engineering, will be utilized to fabricate and characterize nanoparticles, nanowires, nanofilms, nanocomposites, etc.

• Atomic Force Microscope (AFM)
• AC and DC Power Supplies
• Capacitance Measurement Device
• High-Speed Centrifuge
• Hotplates/Stirrers
• Sonicators
• Spin Coater
• ESA Coating Unit
• Optical Microscopes
• UV Photolithography
• Plasma Cleaner and Sensitizer

ME 533 Mechanical Engineering Laboratory
Purpose of Laboratory

This course is designed to give junior-level students hands-on experience and theoretical background in the fundamentals of measurement and instrumentation for mechanical engineers. The experiments and demonstrations also illustrate the fundamentals of solid and fluid mechanics (Figure B.6.1). Students set up and operate instrument systems for measuring various physical parameters such as pressure, temperature, displacement, force, strain, sound, and vibration. The data collected is analyzed to demonstrate and reinforce many basic engineering concepts, such as Bernoulli’s Law, Fourier’s Law and the behavior of first- and second-order systems. Experiments are performed in small groups, and each student prepares an independent laboratory report. Development of report writing skills and technical writing is also a feature of this laboratory. The preparation of reports also requires that students develop skills with word processing applications, spreadsheet calculations, and scientific graphing.

![Figure B.6.1. Student Taking Readings from a Fluid Mechanics Experiment.](image)

Equipment

The Mechanical Engineering Laboratory is physically located in one room in Wallace Hall (Room 109). This large room contains adequate counter space and utility services for the experiments, and a large open area serves as lecture space and contains work tables and chairs.

Laboratory equipment and instrumentation can be categorized into two groups. The first group consists of dedicated experiments, which are set up in permanent locations. Some of these experiments have been purchased, and some have been fabricated by WSU students and faculty. A list of these experiments includes the following:

- Heat transfer conduction
- Heat transfer through extended surfaces
- Air flow loop with flow metering apparatus
- Hot wire anemometer calibration and turbulent jet measurement
• Air flow around a cylinder
• First-order system blow-down and equivalent first-order electrical system
• Second-order system characteristics and damping
• Strain gage calibration
• Calibration of a pressure transducer
• Force and distance displacement sensors

In addition to the fixed laboratory demonstration experiments, there is a variety of other instrumentation available, including the following:

• Oscilloscopes, function generators, counters and multimeters
• Strain gages and strain gage bonding materials
• Sound level meter and calibrator
• Light meter
• Pitot tubes, pressure transducers, and manometers
• Thermocouples, thermistor, and RTD temperature indicators
• Optical pyrometers
• Personal computers with LabVIEW DAQ software and/or analog I/O boards and C++ software
• Falling ball viscometers and a Saybolt viscometer
• Precision specific gravity floats
• NI Elvis system and DAQ (NI Educational Laboratory Virtual Instrumentation Suite)

**ME 633  Mechanical Engineering Systems Laboratory**

**Purpose of Laboratory**

This laboratory is intended as an integrative experience for senior-level mechanical engineering students. Students integrate their knowledge of several basic areas of mechanical engineering through set-up and performance of several different laboratory experiments. The equipment and instrumentation are available for these experiments. Students plan the strategy for running the experiment; then they run the experiment, collecting and reducing the data; and finally, they present the results in the format of technical presentations at a formal engineering conference. Students must prepare professional caliber engineering presentations requiring written proficiency in the preparation of comprehensive MS PowerPoint presentation materials that emphasize oral communication skills. Each laboratory team is required to give four group oral presentations on four of the five experiments. Additional short reports are required to communicate about the semester-long design project. There is also a semester project to design and develop laboratory experimental facilities. The general nature of the laboratory is open-ended work.

**Equipment**

The primary location for this laboratory is in Wallace Hall 114. Facilities in WH 109 and WH 124 are also used for conducting this course. Currently this laboratory and the equipment associated with it are in generally good condition. Most instrumentation is current or remains appropriate, and new experiments have been developed by the students. In many instances, this development
involves the purchase of new apparatus and instrumentation.

Several major experimental facilities provide experience with operation and analysis of mechanical engineering systems. These are equipped with standard instrumentation for the measurement of temperature, pressure, flow, and other parameters:

- A centrifugal pump loop with recirculation tank and appropriate instrumentation
- A diesel engine-dynamometer facility appropriate for performance and fuel efficiency testing
- A diesel engine instrumented for measurement cylinder pressure
- A bomb calorimeter test facility for determining the gross heating value of diesel fuel
- Twelve data acquisition (DAQ) training/test stands equipped with DAQ hardware and software developed by National Instruments (NI) to provide students with hands-on NI LabVIEW-based data acquisition experience

All students complete a series of modular LabVIEW training activities and perform a LabVIEW data acquisition exercise over the course of the first four weeks of the semester. Several major industries in the region that are engineering employers are enthusiastic about these LabVIEW-based training activities.

**ME 662 Mechanical Engineering Practice—Design Laboratory**

**Purpose of Laboratory**

The Mechanical Engineering Practice Design Laboratory is a design and team-collaboration resource for the capstone design course, ME 662 Mechanical Engineering Practice. This course is included in the laboratory for analysis and design software, which also accommodates industrial projects and in making professional presentations for our industrial project sponsors. An Internet-based telecommunication station and “World Time Clock Suite” is available for global collaboration as needed. The facility has been used for hands-on design and analysis software workshops for the students as well. Much of the senior design project work is done in group sessions utilizing the resources of the Mechanical Engineering Design Laboratory and that of the WATC, as shown in Figure B.6.2. Numerous reference materials are available through University Library Reserves, including specific analysis and reference texts, and DVD video of current oral reports.
ME 450 Creative Design and Practice Laboratory

This facility, located at the Wichita Area Technical College, is comprised of several laboratories. An agreement between WSU and WATC enables mechanical engineering students to use this facility. All laboratory experiments are done with appropriate instructors who are hired by WSU.

Purpose of Laboratory Collaboration

The purpose of this collaboration is to provide mechanical engineering students at Wichita State University experience in mechanical engineering application skills to supplement their engineering science requirements. This enables ME graduates to develop effective engineering designs, taking into account manufacturing capabilities and real constraints. This will also enable more effective training for engineering students working in teams with engineering technologists, in research and development of new products, and in process designs. The collaboration helps satisfy some of the ABET criteria for program outcomes as well as addresses some of the problems associated with the lack of equipment and a workshop in the department.

Approach

Mechanical engineering students take the new course (ME 450 Selected Topics in Mechanical Engineering—Creative Designs and Practice) as part of their electives. Lectures are given at WSU, but laboratory sessions are provided at WATC and include machining, joining processes, composite fabrications, engine testing, and air conditioning systems. Students become familiar with technologies beyond what the college’s existing facilities can afford. These laboratories are as follows:

Machining Processes Laboratory

This laboratory allows students to gain knowledge of various manufacturing procedures and operations including lathe and mill operation and an introduction to CNC. Lab assignments include safety, proper use of hand and power tools, reading and sketching of blueprints, precision measuring and layout, setup and operation of the lathe, proper use of milling machine and surface grinders, and a basic introduction to CNC operation (Figure B.6.3.)
Welding Laboratory

This laboratory allows students to gain first-hand knowledge and skills in cutting, arc welding, MIG, and TIG welding, and provides some exposure to oxy-acetylene cutting and welding. Lab assignments include safety, blueprint reading and sketching, tools and materials used in the various forms of welding, weld testing, and fabrication of various welding projects (Figure B.6.4).
Composite Fabrication Laboratory

This laboratory introduces students to various phases of the composites industry, including process and product design, tool and mold design, product and process manufacturing, and quality assurance. Students receive hands-on working knowledge of the manufacturing methods and techniques used in today’s composite industries (Figure B.6.5).

B.6.3 Computing and Information Infrastructures

The computing facilities available to mechanical engineering students are as follows: (a) common computing facilities that are shared by all College of Engineering students and are supported by the dean’s office, and (b) mechanical engineering computing facilities that are open only to the mechanical engineering students and are equipped by the Department of Mechanical Engineering.

Mechanical Engineering Design Laboratory
Purpose of Laboratory

The Mechanical Engineering Design Laboratory, located in Wallace Hall, is a mechanical engineering facility. It primarily serves undergraduate students but is also open to graduate students. Its purpose is to provide a design and analysis facility that will allow students to gather information and work on their design projects. The laboratory is used in ME 662 Mechanical Engineering Practice and elective design courses. To accomplish this, it is equipped with current technology computational facilities with software particularly appropriate to mechanical engineering. A wide variety of reference materials are accessible through library reserves, ranging from handbooks, such as the *Marks Mechanical Engineers Handbook*, to CD-ROM databases, such as the Thomas Register and ASHRAE handbooks. These resources are maintained to reasonably current standards and are intended to reflect software, handbooks, and vendor information typically used by practicing engineers. Examples of software available for elective design courses is given later in the “Opportunities to Learn the Use of Modern Engineering Tools” section.

Equipment

This laboratory is equipped with fifteen Pentium microcomputer work stations and a laser printer. These machines are all connected to the College of Engineering LAN system and have access to all the software and services available through that system. There is also locally installed software that is specific to the needs of this laboratory. Examples include vendor catalogs, CD-ROM databases and search systems, and unique single-copy software. A large collection of hard-copy vendor catalogs is also available in this facility, as well as copies of popular handbooks such as the *Marks Mechanical Engineers Handbook*, *Roark’s Formulas for Stress and Strain*, *Society of Automotive Engineers Handbook*, materials handbooks, etc.

The facility also has a work and conference area equipped with tables, chairs, and blackboard space for team meetings, and a VCR and monitor system for viewing available reference video tapes. A controlled telephone line gives student design teams access to vendors, corporate sponsors, and other informational resources.

B.6.4 Opportunities to Learn the Use of Modern Engineering Tools

Twelve computers with the latest LabVIEW version are available to mechanical engineering students in ME 633 Mechanical Engineering Systems Laboratory. By taking required and appropriate elective courses, ME students have the opportunity to learn the use of various codes currently used in the industry. Examples are as follows:

- *Pro/ENGINEER* and *CATIA*, used in ME 637 Computer-Aided Engineering
- *ANSYS*, used in ME 639 Application of Finite Element Methods in Mechanical Engineering
- *MATLAB, C, Excel, and Visual Basic*, used in ME 325 Computer Applications
- *Pipe Flow*, used in ME 641 Thermal System Design
- *HVAC Cooling Load and Duct Design*, used in ME 544 Design of HVAC Systems
Through either the college LAN or the library computers, mechanical engineering students can access the following engineering databases and electronic resources, which are maintained by Ablah Library (Wichita State University Libraries): Aerospace Database, AIAA Online Technical Meeting Papers, Applied Science and Technology Full Text, ASM Handbooks Online, Compendex via Engineering Village 2, Directory of Published Proceedings (DoPP), Ergonomics Abstracts Online, IEEE Xplore, INSPEC, Knovel Library, Materials Science: A SAGE Full-Text Collection, MInd: The Meetings, Index, NTIS, and numerous scientific journals.

B.7.1 Laboratory Development Plans

In 2005, the ME department lab committee submitted a proposal requesting funds for equipment, supplies, and software for instructional purposes and laboratory development for timeframes ranging from immediate to long range (3 to 5 years). The ME laboratory committee plans to continue improving the ME laboratories over the next three to five years. It is anticipated that each of the labs will develop new experiments with a summary as shown in Table B.7.2. The laboratories will have mechanical and electrical tools for normal operation of the experiments but will depend on Technology Support Services for tools and for major repair and diagnosis of mechanical, electrical, or software/network problems.

B.7.2 Plan for Development of ME 251 Laboratory

ME 251 Materials Engineering Laboratory serves to integrate materials science and mechanical engineering in four focal points: mechanical behavior, materials processing, materials development, and materials characterization. ME students use the ME 251 lab extensively to learn hardness (Rockwell and Vickers), tension, impact, creep, cold rolling, heat treatment, grain size and shape measurements, and micro polishing tests on various metals, polymers, and composites. In order to improve the ME 251 lab capabilities, three additional tests are planned for ME students, including a fatigue test, Charpy impact test, and environmental chamber test.

B.7.3 Plan for Development of ME 533 Laboratory

The mechanical measurements class ME 533 Mechanical Engineering Laboratory introduces undergraduate students to the fundamentals of mechanical measurement, including terminology, signal and system characteristics, experimental theory, methods, equipment, and techniques used in various engineering applications to obtain measurements for experimental and industrial purposes. An associated lab section incorporates the various instruments used in industry mechanical engineering measurements, providing opportunities for development of laboratory measurement and documentation skills. It provides the necessary background in instrumentation and theory to continue in ME 633 Mechanical Engineering Systems Laboratory, which stresses system level experimentation and experiment development using data acquisition-based instrumentation. Currently in ME 533, students learn first- and-second order system response characterization, statistical analysis concepts, signal measurement and characterization, measurement of temperature, pressure, and flow, characterization of sensors such as force and displacement, and system-level measurement studies in drag and thermal conductivity. The goals of the next phase of the ME 533 laboratory development plan are to do the following:

- Incorporate new sensor technologies into the experiment curriculum representing new developments in measurement technology.
• Develop new and modified experiments involving independent experimentation, problem solving, data gathering, and scientific interpretation.
• Upgrade several large-capital legacy test systems with instrumentation representative of industry practice.

The improvement plan for the ME 533 lab is applied to three areas:

• Experimental Workstation and Sensor Integration
• Vibration System Maintenance and Modernization
• Flowmeter Experiment Modernization

B.7.4 ME 633 Mechanical Engineering Systems Laboratory

Instructional activities in ME 633 Mechanical Engineering Systems Laboratory will remain essentially the same in the foreseeable future. New fuel cell facility is planned. The addition of a fuel cell test facility will add emphasis on advanced energy conversion. Modification of existing facilities to allow remote access to the facilities via the web is also planned and will allow the exploration of the potential to offer the course online. The emphasis on data acquisition systems will be maintained through the continued inclusion of National Instruments LabVIEW tutorial modules. In the future, the design portion of the laboratory will return to the more traditional design of experiment (both facilities and accompanying experimental methods), rather than the data acquisition system design project that is currently used.

B.7.5 Plan for Development of ME 662 Laboratory

The development plan of the ME 662 Mechanical Engineering Practice course, or “senior design,” would include project collaboration initiatives with the Wichita Area Technical College (WATC), the Entrepreneurship Program at Wichita State University, and global learning and collaboration.

Joint ME student and WATC projects recognize the collaborative structure of engineering technologists and engineers in industrial product development, and the benefits gained by students from each institution working together on a design project. Well-developed manufacturing facilities at WATC are currently used to work on cooperative projects, and major capital tools such as CNC machines, milling and lathe machines, and drills are available to the teams. Dedicated kits, including Electrical and Electronic Toolkits, and Mechanical Tool Sets, for student check-out and use would be a part of the hands-on aspect of project development.

The entrepreneurship collaboration initiative seeks to involve engineering students in product development activities with WSU Entrepreneurship students to develop actual products as part of their education. Acquisition of MS-Project software for mechanical engineering students to utilize would provide consistent planning capabilities for coordination.

The global learning and collaboration initiative seeks to provide engineering students with the knowledge and background to understand, communicate, and coordinate engineering activities with people of different cultures. In addition to understanding and practicing techniques of global learning, a communications collaboration facility is needed similar to the one at Spirit
AeroSystems in Wichita, Kansas. The facility would be a long-term effort over a period of five years. The initiative covers all departments in the College of Engineering and is proposed to be in Engineering Building Room 201.

B.7.6 Plan to Develop Nanotechnology Laboratory and Research Facilities

The objectives of the Nanotechnology Laboratory are to design, fabricate, analyze, and test structures and systems at nanoscale. In this lab, students will study nanotechnology to improve their skills, which will also improve their job-finding opportunities in the near future. We strongly believe that laboratory experiments in nanoscale are essential for engineering students to enhance their practical knowledge after fundamental concepts. The following tests are planned for ME students:

- Nanoparticle Fabrication
- Nanowire/Nanofiber Fabrication
- Nanofilm (or ESA Film) Fabrication
- Nanocomposite Fabrication
- Microfluidic Device Fabrication

B.7.7 Plan for Further Use of Facilities at WATC

Due to the collaborative effort between the Department of Mechanical Engineering and the Wichita Area Technical College, laboratory facilities are available for other ME courses. The courses and related lab modules, which could utilize WATC facilities, are shown in Table B.7.1.

<table>
<thead>
<tr>
<th>Lab Module</th>
<th>Number of Sessions</th>
<th>ME Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive Chase Dynamometer</td>
<td>1</td>
<td>633</td>
</tr>
<tr>
<td>Automotive Exhaust Systems</td>
<td>1</td>
<td>633</td>
</tr>
<tr>
<td>Hydraulics</td>
<td>2</td>
<td>533</td>
</tr>
<tr>
<td>Nondestructive Testing and Measurement</td>
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<td>533</td>
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<tr>
<td>Advanced Machining</td>
<td>4</td>
<td>637</td>
</tr>
<tr>
<td>Miscellaneous Senior Design Projects</td>
<td>6</td>
<td>662</td>
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B Course Syllabi

<table>
<thead>
<tr>
<th>Department</th>
<th>Category</th>
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<tbody>
<tr>
<td>ME</td>
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<td>Materials Engineering</td>
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<tr>
<td>ME</td>
<td>251</td>
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<tr>
<td>ME</td>
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<tr>
<td>ME 522</td>
<td>Heat Transfer</td>
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<td>Design of HVAC System</td>
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<td>Heat Exchanger Design</td>
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<td>Applications of Finite Element Methods in ME</td>
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<td>ME 659</td>
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<td>ME 662</td>
<td>Senior Engineering Practice</td>
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<td>ME 664</td>
<td>Introduction to Fatigue and Fracture</td>
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<td>ME 665</td>
<td>Selection of Materials for Design and Manufacturing.</td>
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<td>Manufacturing with Materials.</td>
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<td>ME 667</td>
<td>Mechanical Properties of Material</td>
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<td>ME 669</td>
<td>Acoustics</td>
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<td>ME 719</td>
<td>Basic Combustion Theory</td>
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<td>ME 729</td>
<td>Computer Aided Analysis of Mechanical Systems</td>
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<td>ME 747</td>
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<tr>
<td>ME 762</td>
<td>Polymeric Composite Materials</td>
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ME 250  Materials Engineering

Spring Semester, 2007

Catalog Data:  ME 250: Materials Engineering. Credits 3. Study of important structural materials used in engineering, including metals, ceramics, polymers and composites, primarily from a phenomenological viewpoint. Prerequisites: Chem 211 and Math 242.


Reference Books:

Course Objectives:  This course provides knowledge of materials including high-performance composites, new engineering ceramics, high-strength polymers, glassy metals, new high-temperature alloys for gas turbines and compound semiconductors. It involves an understanding of the basic properties of materials and of how these are controlled by structure and processing (i.e. heat treatment or aging). With the knowledge of this course students should be able to design with an emphasis in the selection of materials based on their properties. Students were expected to gain or show that they possessed:
   A basic understanding of materials structure and properties.
   An ability to apply the knowledge of mathematics and chemistry.
   An ability to solve engineering problems.
   An ability to select materials for a particular design component.
   An ability to communicate effectively and work in a group.
   An ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by topic:
1.  Algebra and Trigonometry
2.  University Chemistry

Topics (1 class = 75 minutes):
   Materials for Engineering (1 class)
      Types of Materials. From structure to properties.
   Atomic Bonding. (2 class)
   Crystalline Structure. (3 class)
   Seven system and fourteen lattices. Metal, ceramic, polymeric and semiconductor structures.
   Lattice positions, directions and planes, x-ray diffraction.
   Crystal Defects and Imperfection and Material Selection. (2 class)
      Solid solution. Point, linear and planar defects. Non-crystalline solids.
   Diffusion (2 class)
Mechanical Behavior (2 class)
Viscoelastic deformation.

Failure Analysis and Prevention (2 class)

Phase Diagrams (2 class)

Heat Treatment. (2 class)

Metals (2 class)
Ferrous and non-ferrous alloys.
Ceramics and Glasses (2 class)
Ceramics. Glasses. Glass-ceramics
Polymers (2 class)
Polymerization. Structural features of polymers. Thermoplastic and thermosetting polymers.
Additives.

Composite Materials. (2 class)
Fibers reinforced and aggregate composites. Mechanical properties of composites.

Material Selection. (2)
Material properties – engineering design parameters. Selection of structural materials.

Design and Material Selection. Project Presentation (2 class)
Examinations. (3 class)

Engineering Design:
Comprehensive project involving material selection and design of a commercially used device.

Written and Oral Communications Skills:
Written reports are required from each student describing the results of their materials selection projects. Teams are used on projects. Presentation of projects in class is required.

Computer Usage:
None specifically assigned. Students are encouraged to use the necessary software to search for materials for their project. Also the project is required to be prepared using a computer.

Estimated ABET Category Content:
Engineering Science: 2 credits or 66 %
Engineering Design: 1 credit or 33 %

Relation to program outcomes:
A basic understanding of materials structure, properties and selection is an essential requirement for aerospace, mechanical, industrial and manufacturing engineers. (Criterion 3 (c))
Potential employers and graduate programs expect the students to have ability to:
Apply knowledge of mathematics and science. (Criterion 3 (a))
Identify, formulate, and solve engineering problems. (Criterion 3 (e))
Select materials for design components. (Criterion 3 (c))
Communicate effectively, work in a team and educate themselves. (Criterion 3 (d), (g)& (i))
Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: J. E. Talia, Professor Date: 01/10/07
ME 251 - Materials Laboratory

Catalog Data: ME 251: Materials Engineering Laboratory. (1). 3L. Companion laboratory course to Materials Engineering. Experimental study of important structural materials used in engineering, including metals, polymers, and composites. Co-requisite: ME 250

Textbooks: Laboratory manual prepared by the Mechanical Engineering Department.

References:

Course objectives: To familiarize the student with standard test apparatus and procedures and to demonstrate fundamental material properties used in engineering. Students were expected to gain or show that they possessed:
A basic understanding of materials properties and testing.
An ability to apply the knowledge of mathematics, science and engineering.
An ability to solve engineering problems.
An ability to communicate effectively.
An ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by topic:
1. English composition.
Materials preparation laboratory:
Saws Cut off Machines, Stirrer/Hot Plates, Polishers & Sanders, Furnaces, Metallurgical Furnaces, Lab ovens, Ultra Sound Cleaners, Digital Thermometers, X-Ray Generator with Double Crystal Diffractometer, Camera, Optical and Inverted Microscopes, Multimeter and Balances.
Topics: (1 laboratory = 150 minutes)
Tension testing of metals and composites. (4 class)
Aluminum sheet specimens were loaded to failure in tension in a completely automated MTS tension testing machine. Elastic modulus, yield strength, tensile strength, strain hardening exponent and other properties were determined. Specific strength and specific stiffness of selected plastics and composites were investigated.

2. Fatigue strength of smooth and notched specimens. (2 class)
Lifetimes under various cyclic loading and fatigue strength of aluminum alloys were investigated using a fatigue dynamics testing machine and plotting S-N data.

3. Heat treatment of metals, and its effect on hardness and impact testing. (6 class)
Plain carbon steel specimens are heat treated at several different temperatures. The hardness and impact properties of heat treated specimens were compared using Rockwell Hardness Tester and Tinius Olsen impact testing machine.
4. Room Temperature Creep. (2 class)
Continued extension of high density polyethylene under constant load is investigated using SATEC model LD creep machine. Creep rate is determined from the secondary region of the graph.

5. Ductile brittle transition temperature of ferrous alloys. (2 class)
Impact test is performed on charpy v notched specimens of steel heated or cooled at different temperatures.

6. Polishing and Micro Hardness Test
Al specimens bound in epoxy are ground using sand papers and then polished with polishing cloths and Al oxide polishing micro/nano particles. Hardness values of the specimens are determined using Vickers Hardness method.

7. Final Examination (1 class)

Written and Oral Communication Skills:
Written reports are required from each student describing and analyzing the results of their experiments.

Computer Usage:
All reports are required to be either typed or computer generated. Students can use available computers and software as appropriate in performance of their projects and preparation of reports. The universal testing machine used in the laboratory is computer controlled.

Ethical, Social, Economic, and Safety Considerations:
Safety in the laboratory is stressed. Hazard areas are clearly marked and students are given particular instruction in the safe conduct of experiments and safety in the laboratory in general.

Estimated ABET Category Content:

Engineering Science: 1 credits or 100%
Engineering Design: 0 credits or 0%

Relation to program outcomes:
1. A basic understanding of materials properties and testing is an essential requirement for mechanical and manufacturing engineers. (Criterion 3 (a))
2. Potential employers and graduate programs expect the students to have ability to:
   Apply knowledge of mathematics, science and engineering. (Criterion 3 (a))
   Identify, formulate, and solve engineering problems. (Criterion 3 (e))
   Communicate effectively, work in a team and understand ethical responsibility. (Criterion 3 (d), (f) and (g))
   Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: R. Asmatulu, Asst. Professor, Mechanical Eng. Date: 02/10/07
ME 325 Computer Applications

Catalog Outline: Required course: ME 325. Computer Applications (3). Introduces the essential computer tools necessary for the mechanical engineering (ME) curriculum. Covers basic word processing and spreadsheet skills, C programming language as applied to ME problems. Also covers Matlab. Includes fundamentals of linear algebra and other computational tools. Prerequisite: MATH 243 with a grade of C or better. Prerequisites by Topic: Math 243 (Differential Equation)


Course objectives: This course is designed to teach the students skills necessary for numerically solving problems in mechanical engineering courses. The student will be able to write efficient computer programs in one or more contemporary languages and prepare laboratory reports in a professional manner. Apart from the above mentioned objectives the students are required to learn the following:

- Learn the basics of linear algebra.
- Matrix operation: Addition, Subtraction, Multiplication, Inverse, Determinant …
- Solving system of linear equations.
- Learn to use statistics in excel.
- Computer hardware, operating systems and networking concepts.

Lecture Topics (1 class period is 75 minutes):
1. Introduction to Excel
   Entering and editing Text and Constants
   Creating a simple Workbook
   Writing Formulas using operators
   Some simple problems

2. Function Wizard
   Types of functions
   Mathematical, Logical, Statistical and Trigonometric Functions
   Engineering Applicationsc. (System of linear equations, Linear Regression…)

3. Graphing Data
   X-Y Graphs (Scatter Charts)
   Line Graphs
   Bar Graph
   Pie Chart
   Applications

4. Introduction to C programs
   C background
   Program development cycle
   Developing simple C programs.
   Function and output format.
5. Basic data types and operators
Characters, integers, single and double precision floating point numbers.
Variables, arithmetic operators, expressions.
Basic input/output statements.

6. Control structures
Decision control structures- if statements, if-else and nested if-else.
Loop control structure-while, do-while loops, for statement, break and continue statements.

7. Introduction to functions
Introduction, user-defined functions.
Scope and storage of variables and functions
Math library functions.

8. Arrays and pointers
Introduction to arrays, initializing arrays, character arrays, one-dimensional and multi-dimensional arrays.
Introduction to pointers, pointer type, pointer arithmetic, relationship between pointers and arrays.

9. MATLAB programming
Introduction to MATLAB
Variable and variable arithmetic
Matrices and matrix arithmetic.
Control structures
Program development using M-files.
Practical applications.

10. MATLAB Graphics
Two-dimensional plotting.
Three-dimensional plotting.
Creating mesh, surface plots and contour plots.

11. Linear Matrix Equations using MATLAB
Linear matrix equations.
Engineering applications.

Estimated ABET Category Content:

Engineering Science: 3 credits or 100 %
Relation to Program outcomes:
Course Outcome and Relation with Program Outcome
The course addresses the following program outcomes:
Students learn to write programs using Excel, C and Matlab (Criterion k).
Students learn to solve mathematical and engineering problems (criterion a)
Students learn to formulate and design a program to solve engineering problems (criterion c and e)

Prepared by: B. Bahr, Professor Date: 4/3/07
**ME 339 – Design of Machinery**

Catalog Data.
ME 339. Design of Machinery. (3 Credits) Introduction to engineering design process; design and analysis. Basic kinematics motions and force analysis in mechanisms such as planar linkages, gears and cams. Synthesis and design of planar linkages and simple cam systems. Computer applications. Design Projects. Prerequisites: IE 222 and ME 360A (or AE 373), which may be taken concurrently.


Coordinator: H. Lankarani, Professor and Boeing Fellow Mechanical Engineering.

Course Objectives:
1. Understand the concepts of kinematics and dynamics in design of machinery.
2. Learn the use of computer-aided engineering as an approach in engineering design.
3. Learn the art of design process with real engineering problems in practice.

Topics (1 class = 75 minutes):
1. Introduction (3 class)
   - Design process
   - Degrees of freedom and mobility, Grubler and Kutzbach's equations
   - Fourbar linkage, Grashof's law, slider-crank mechanism, Watt's and Stephen's sixbars
   - Kinematic inversions, isomers, linkage transformations
2. Position Analysis (3 class)
   - Vector loop closure
   - Graphical methods, analytical methods, numerical procedures
3. Computer Software (2 class)
   - Programs FOURBAR, FIVEBAR, SIXBAR, DYNAFOUR, DYNACAM, ENGINE
   - Programs description, modeling techniques, programs use in design
4. Mechanisms Design (5 class)
   - Linkage design/synthesis
   - Design of function, path, and motion generators, design of dwell mechanism
   - Prescribed positions, precision points, and timing, cognates, Cayley and Roberts diagrams
5. Term Projects (3 class)
   Examples include: design of an aircraft elevator control mechanism, design of a boat launching and retrieving mechanism, design of an autonomous surveillance vehicle, design of a hand-operated chair for head and foot rest control, design of a foot-pedal actuated mechanism for handicaps to turn book pages, design of an aircraft landing gear system. projector
6. Velocity Analysis (4 class)
   - Angular velocity, velocity difference and relative velocity
   - Graphical methods: velocity polygons, instantaneous centers
   - Analytical methods: linear algebraic velocity equations, numerical procedures
7. Acceleration Analysis (3 class)
   - Normal and tangential accelerations
   - Graphical method: acceleration polygons
- Analytical methods: linear algebraic acceleration equations, numerical procedures

8. Dynamic Fundamentals (2 class)
   - Newton's laws of motion, d'Alembert principle, energy methods
   - Moments of inertia, radius of gyration, radius of percussion

9. Dynamic Force Analysis (3 class)
   - kineto-static analysis
   - Newtonian and energy approaches
     - Graphical, analytical, and computer methods
     - Friction modeling, flywheel design, balancing

10. Introduction to Cam Design (3 class)
    - S V A J diagrams
    - Harmonic, cycloidal, polynomial

Computer Usage:
   Students are exposed to many computer programs for analysis and design of mechanical systems. These programs include FOURBAR, FIVEBAR, SIXBAR, DYNAFOUR, DYNACAM, and ENGINE. The students use the programs throughout the course for both their homework assignments and their projects. In addition, spreadsheet software such as QuatroPro, geometric drawing packages such as AutoCAD, and math packages such as TK-Solver and MathCAD, are also used by students in their work in this course.

Projects:
   Students are expected to design several mechanisms, from simple to complicated ones, throughout the course. Students work in teams on their mechanism design term projects. They are also expected to build working prototypes of their designs and demonstrate their function.

Engineering Design:
   The students are continuously instructed throughout the course to use their creativity in the design of different machines and mechanisms and fabricating their designs. Modern theories of design of machinery are taught to the students.

Written and Oral Communication Skills:
   Students are required to submit a final report for their project in a required typewritten formal format. The students also give short oral presentations on their project and demonstrate the function of their design prototypes in front of the class.

ABET category content as estimated by faculty member who prepared this course description:
   Engineering science: 1 credit (33%),
   Engineering design: 2 credits (67%)

Relation to Program outcomes:
   Fundamental knowledge of kinematics and dynamics and their application in mechanical systems design are essential for engineers working in this field. (Criterion 3 (c) & (k))
   Potential Employers and graduate program expect the students to have the ability to:
   - Apply knowledge of mathematics, science and engineering. (Criterion 3 (a))
   - Identify, formulate and solve motion system problems in engineering. (Criterion 3 (e))
   - Communicate effectively. (Criterion 3 (g))
   - Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: H. Lankarani, Professor and Bombardier/Learjet Fellow Date: 2/1/07
**ME 398 – Thermodynamics I**

Catalog Data:
ME 398: Thermodynamics I. Credits 3. An introduction to the terminology and analysis techniques specific to thermodynamics centered around a study of the First and Second Laws of Thermodynamics. Prerequisites: MATH 243 and PHYS 313.

Textbook:

Reference Books:

Coordinators/Instructors: D.N. Koert, Associate Professor of Mechanical Engineering.

Course Objectives: Gain a thorough understanding of the First and Second Laws of Thermodynamics. Become competent and completely conversant with the terminology, symbols and units specific to thermodynamics. Illustrate the broad application of theory to many of the processes common to energy conservation systems. Improve problem-solving abilities by emphasizing a systematic approach to defining and analyzing problems. Learn the use of tables, charts, and other sources of important thermodynamic data.

A basic understanding of thermal properties and processes.
A basic understanding of the Principles of the conservation of mass and energy
An ability to apply the knowledge of mathematics, physics and chemistry.
An ability to solve engineering problems.
An ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by topic:
1. Differential and integral calculus
2. Thermal properties of matter
3. Basic concepts of work and energy
4. Molecular properties of matter
5. Principles of the conservation of mass and energy

Topics (1 class = 75 minutes):
1. Basic concepts and definitions (3 hours)
2. The First Law of Thermodynamics (6 hours)
3. Pure substances and the ideal gas model (6 hours)
4. Control volume energy analysis (6 hours)
5. The Second Law of Thermodynamics (6 hours)
6. Entropy (8 hours)
7. Exergy analysis (5 hours)
8. Introduction to thermodynamic cycles (2 hours)
9. Examinations (3 hours)
10. Problem sessions (optional; arranged outside of regular class meetings)

Engineering Design:

Written and Oral Communications Skills:

Computer Usage:
An extra credit project (that nearly all students submit) requiring numerical methods is assigned. The project specifies the use of specific heat data in the form of high order polynomials in temperature to be ‘refit’ to third polynomials, etc.

Estimated ABET Category Content:

Engineering Science: 3 credits or 100 %
Engineering Design: 0 credit or 0 %

Relation to program outcomes:
A basic understanding of thermodynamics is an essential requirement for aerospace, mechanical, industrial and manufacturing engineers. (Criterion 3 (c))

Potential employers and graduate programs expect the students to have ability to:

a) Apply knowledge of mathematics and science. (Criterion 3 (a))
e) Identify, formulate, and solve engineering problems. (Criterion 3 (e))
k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: D. N. Koert, Associate Professor Date: 04/10/07
ME 450 Creative Design and Practice

Catalog Data: Elective Course. 3 Credits. This course will provide effective first hand exposure to manufacturing techniques such as machining, welding, and composite blue print reading and fabrications. Students will be expected to participate in seminar series that will expose them to topics such as Ethics, Safety, Environmental issues, Global Collaborations, Energy conservation, Entrepreneurial aspects of Engineering, Engineering Professionalism, Sustainability, Manufacturability, Project Management, and other scientific topics. Furthermore, students will have opportunities to work as a team on faculty’s research project or a creative project of their own. The students will be required to write a report and present it.

COORDINATE: Dr. Behnam Bahr, Professor of Mechanical Engineering, Rm 101T EB.

TEXT BOOK


PREREQUISITE

ME -250 and ME 339 or ME 439

Topics (Each Lecture is 50 Minutes)

Practice Lectures: There will be weekly Mechanical Engineering Lectures: students have to attend all of them. In these lectures, the department will have speakers for various topics such as Ethics, Safety, Environmental and Global warming and Globalization issues, Energy considerations, Entrepreneurial aspects of Engineering, Engineering Professionalism, Sustainability, Nanotechnology, and other scientific topics. Furthermore, the lectures will include the review of the Fundamentals of Engineering. (The FE preparation is your responsibility however, I will have two weeks of review during Saturdays). The students will be required to write short reports several reports on the above topics.

Review Topics will be covered from 8:30- 2:30, on April 14 and 21.

Fluid Mechanics
Heat Transfer
Automatic Controls
Measurement and Instrumentation
Computers
Stress Analysis
Mechanical Design
Dynamic Systems
Thermodynamics I
Thermodynamics II
Energy Conversion & Power Plants

Laboratories: (Each lab is 150 Minutes)
The laboratory facility provided at WATC for learning safe and efficient operation of equipment. Students will learn capabilities and limitations of different manufacturing processes and effective communication from engineers to machinists, welders, etc. This lab will highlight the various issues that often arise between the conceptual design and the final fabrication phases. These labs will be as follows

Machining Processes Laboratory (5 Weeks)

Welding Laboratory (5 Weeks)

Composite Fabrication Laboratory (4 Weeks)

Creative Research Project (teams of three): Students will work with a professor of their choice. The faculty will be responsible for the oversight of the student final project, and the grade for the project will be given to the instructor of the course.

Safety Exam:
Handouts available on the ME website and there will be an exam before you can use the labs.

Estimated ABET Category Content:
Engineering Science: 1 credits or 34%
Engineering Design: 2 credit or 64%

Relationship to Outcomes:

The students will be able to practice on modern equipments to machine tools, and joining processes for both metal and composite (Criterion K)
The students will be able function on a team for their research/project (Criterion d, c)
The student will be able to consider the ethical, safety, environmental, and other issues to consideration when they design their components. (Criterion h and J)
Students are required to prepare for the Fundamental of Engineering Exam by their own with some review in the class (criterion f, i)
The students will be able to communicate effectively through written report. (Criterion g)

Prepared by: Dr. Behnam Bahr, Professor Date 1/30/07
ME 469. Energy Conversion

Catalog Data:
ME 469. Energy Conversion (3 credits). Energy conversion principles and their implementation in engineering devices including thermal, mechanical, nuclear, and direct energy conversion processes. Prerequisite: ME 398.

Text Books:

References:
Wind Energy Explained, Manwell, McGowan & Rogers, Wiley, 2002

Coordinator/Instructor:
D. Koert, Associate Professor, Mechanical Engineering.

Course Objectives:
This course will present the challenge of changing the global energy system so that it addresses the objective of greatly reducing the dependence on the finite fossil energy sources and move to environmentally sustainable energy sources. The emphasis will be on greenhouse gas emissions free energy production strategies, including renewable energy – solar, wind and biomass. The aims of this course are:
1. To provide an understanding of the concept of sustainable future.
2. To provide critical and thorough introduction to the subject of energy, its use and its environmental effects, especially global warming.
3. To provide an understanding of the role thermodynamic principles in energy conversion.
4. To introduce the major methods of direct energy conversion – thermoelectricity, photovoltaics, thermonics and fuel cells.
5. To provide a survey of renewable energy systems, solar, wind and biomass.

Prerequisites by Topic:
1. General laboratory measurement and instrumentation
2. Thermodynamics

Topics (One class period = 60 minutes):
1. Origins of Renewable Energy (4 classes)
2. Individual Energy Sources (8 classes)
3. Energy Conversion Processes (8 classes)
   4. Energy Transmission and Storage (4 classes)
   5. Energy Supply Systems (4 classes)

Engineering Design: A class project will be undertaken to design and build a hydrogen fuel cell experimental facility. Once completed, the facility will be installed in the new Energy and Engine Dynamometer Lab. The project will be conducted by 4-5 member teams.

Written and Oral Communication Skills: Student must prepare reports in the form of written design reports, poster boards for presentation of a renewable energy topic, and associated oral reports.

Ethical, Social, Economic, and Safety Considerations: The social implications of dwindling energy supplies and the need for renewable energy source is emphasized in the text book, instructional activities and a project in which each student is required to develop a present a poster on a renewable energy topic.

Estimated ABET Category Content:
Engineering Science: 1 credits or 50%
Engineering Design: 2 credits or 50%

Relation to Program outcomes:
Fundamental knowledge of energy conversion systems is essential for engineers working in this field. (Criterion 3 (a))
Potential Employers and graduate program expect the students to have the ability to:
Apply knowledge of mathematics and science. (Criterion 3 (a))
Identify, formulate and solve experimental design problems. (Criterion 3 (b))
Communicate effectively, work in a team and understand ethical responsibility. (Criterion 3 (d), (f) and (g))
Use techniques and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: D. N. Koert, Associate Professor
Date: 1/30/07
ME 502 - Thermodynamics II

Catalog Data: ME 502. Thermodynamics II. (3 Credit). Continuation of ME 398, emphasizing cycle analysis, thermodynamic property relationships, and psychometrics with an introduction to combustion processes and chemical thermodynamics. Prerequisite: ME 398

Textbook:

Coordinator:
David N. Koert, Assistant Professor of Mechanical Engineering

Course Objectives:
1. Extend the student's understanding of the First and Second Laws of Thermodynamics
2. Illustrate the broad application of theory to many of the processes common to energy conservation systems
3. Develop the concepts and methods necessary to treat a broad variety of combustion problems of engineering interest
4. Investigate the behavior of systems in which either mass is transferred between two or more phases during a change of state or an equilibrium chemical reaction occurs.

Prerequisites by topic:
Differential and integral calculus
The First and Second Laws of Thermodynamics
Hydrostatics and hydrodynamics
Basic principles of general chemistry

Topics (1 class period is 50 minutes):
Review of First and Second Laws (10 periods)
Gas and vapor cycles (14 periods)
Behavior of real gases (8 periods)
Nonreactive, ideal-gas mixtures (10 periods)
Examinations (3 periods)

Computer use:
Students are encouraged to use "Interactive Thermo8", software developed to accompany the textbook. This software provides interactive determination of thermodynamic properties and tutorial modules on basic thermodynamics concepts. Students are encouraged to use personal computers (spreadsheets, etc.) for problem analysis.

Ethical, Social, Economic and Safety Considerations:
A portion (30 minutes) of a lecture is devoted to the presentation of biographical sketches of African-American Engineers/Inventors. This lecture is given during National Engineers Week, an annual event in February, which coincidentally is Black History Month.

Estimated ABET Category Content:
Engineering Science: 3 credits or 100%
Design: 0 credits

Relation to Program outcomes:
Students acquire fundamental knowledge of the science and mathematics essential for engineers working in this field. (Criterion 3 (a))
Students acquire problem-solving skills. (Criterion 3 (e))

Prepared by: David N. Koert, Associate Professor Date: 1/30/07
ME 521 – Fluid Mechanics


Textbook:
Fundamentals of Fluid Mechanics by Munson, Young, and Okishi, Wiley.

Reference Book:
Introduction to Fluid Mechanics by R. W. Fox and A. T. McDonald, Wiley.

Instructor: Dr. Ikram Ahmed, Assistant Professor, Mechanical Engineering, Wichita State University
   EB 101D; Campus Mailbox# 0133; E-mail: iahmed@me.engr.twsu.edu; Tel: WSU-6292; ME Fax: WSU-3236

Course Objectives: To familiarize with the fundamentals of fluid mechanics and to apply its basic principles to the following areas:
Newtonian fluids and viscosity,
Hydrostatic pressure and buoyancy,
Incompressible and inviscid flow,
Fluid kinematics and velocity field,
Conservation of mass and momentum for integral and differential control volumes,
Dimensional analysis,
Internal and external flows,
Compressible flow.

Prerequisites by topic:
ME 398 (Thermodynamics: concepts of system, surrounding, and boundary; the state principle; heat and work interactions; properties of pure substances, the First and Second Laws) Differential Equations (of the first and second orders; separation of variables; initial value problems; power series; Laplace transform).

Topics: (1 Class = 50 minutes)
Basic Concepts (Continuum, the No-Slip Condition, Viscosity, Newtonian Fluids) (2 class)
Pressure; Measurement of Pressure; Hydrostatic Forces (5class)
Bernoulli Equation; Static, Dynamic, and Stagnation Pressures; Flow rate Measurements (4 class)
Fluid Kinematics (Descriptions of Fluid Flow; Control Volume and Control System Representations) (2class)
The integral equations of Conservation of Mass, Momentum, Energy (11class)
The differential equations of Conservation of Mass and Momentum (4class)
Similitude, Dimensional Analysis, and Modeling (Buckingham’s theorem) (4class)
Internal Flow; External Flow (the Boundary Layer; Lift and Drag forces) (4class)
Introduction to Compressible Flow (5class)

Class Format: 3 Class Period per week for 14 weeks.
Estimated ABET Category Content:
   Engineering Science:  3 credits or 100%;
   Engineering Design:  0 credit.

Computer Usage:
   Graphical analysis of data using simple PC based software is encouraged through the homework assignments. Additional usage of commonly available mathematical software (EXCEL, Mathematica) for the solution of more involved problems is also expected.

Projects:
   One or two small group projects may be assigned for enhancing and emphasizing the concepts presented in class.

Engineering Design:
   Open-ended, design type problems will be assigned throughout the Semester as part of the Homework assignments.

Relation to Program outcomes:
1. A basic understanding of the principles of fluid mechanics as applicable to engineering problems is an essential requirement for mechanical engineers in an industrial environment. (Criterion 3 (c))
2. Potential employers as well as graduate programs focusing on thermal/fluids areas expect the students to:
   Have a good foundation in the basic concepts of fluid mechanics. (Criterion 3 (c))
   Apply their knowledge of mathematics, science, and engineering in solving practical problems and critically review their own work. (Criterion 3 (a))
   Be able to communicate the results of their analysis in a meaningful and useful way. (Criterion 3 (g))

Prepared by: T.s. Ravi, Associate Professor       Date: 1/30/07
ME 522 – Heat Transfer


Topics (1 class = 75 min.):
1. Fundamentals of conduction, convection and radiation; the conservation of energy; surface energy balance; Problems 1.32, 1.34, 1.44, 1.48, 1.52 (2 classes)
2. Introduction to conduction: the conduction rate equation; the thermal properties of matter; the heat diffusion equation; boundary and initial conditions; problems 2.13, 2.19, 2.25, 2.41, 2.43 (3)
3. One dimensional steady state conduction without and with thermal energy generation: the plane wall; thermal resistance; the composite wall; contact resistance; radial systems; spherical systems; problems 3.9, 3.26, 3.46, 3.77, 3.95 (4)
4. Heat transfer from extended surfaces: general conduction analysis; fins of uniform cross-sectional area; fin performance; fins of non-uniform cross-sectional area; overall surface efficiency; problems 3.100, 3.116, 3.125, 3.132, 3.152 (4)
5. Two dimensional steady state conduction: the method of separation of variables; the graphical method; the conduction shape factor and the heat transfer rate; finite difference form of the heat equation; the energy balance method; finite difference solutions; problems 4.2, 4.27, 4.29, 4.33, 4.39, 4.41, 4.49, 4.66, 4.71 (4)
6. Transient conduction: the lumped capacitance method; spatial effects; the plane wall with convection; radial systems with convection; the semi-infinite solid; multidimensional effects; finite difference methods; problems 5.11, 5.19, 5.42, 5.56, 5.67, 5.74, 5.92 (4)
7. Introduction to convection: convection boundary layers (velocity, thermal, concentration); laminar and turbulent flow; the boundary layer equations; the boundary layer approximations 6.9, 6.24, 6.36, 6.53, 6.60, 6.66 (4)
8. Examinations (4)

Computer Software/programs:
Students are expected to use computer facilities available to them for numerical solutions and word processing in their homework.

Assessment/Grading: The outcome will be assessed through various means and a grade will be assigned to students on the success of course outcome.
Pre-requisite quiz; January 31, 2007 5%
Quiz on chapter 1; February 7, 2007 5%
Tests - all comprehensive (20% + 20% + 20%) 60%
Tentative test dates February 21, March 28 and April 25, 2007
Final May 14, 2007 at 5:40-7:30 PM 30%

A 90%, B 80%, C 70%, D 60%

Office Hours: As posted; e-mail: dennis.signer@wichita.edu; Tel: 978-6300

Assignments & Homework: Students are strongly advised to go through the reading assignments.
before coming to class. Home work problems will be assigned regularly.

Exams: Exams are in-class (closed book). They may consist of 3 or 4 problems covering the chapters discussed since the last exam.

Ethical Issues: All policies on academic honesty will be strictly enforced. Students are expected to do their own work unless permitted otherwise by the instructor in this regard. Any dishonesty detected will result in the student receiving no credit for the examination, written work or quiz, and may result in an "F", suspension, and/or dismissal from the University.

Course Outcomes and Relation with Program Outcomes: The course addresses the following program outcomes

an ability to apply knowledge of mathematics, science, and engineering
an ability to identify, formulate, and solve engineering problems
an understanding of professional and ethical responsibility
a recognition of the need for, and an ability to engage in life-long learning
a knowledge of contemporary issues
an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Estimated ABET Category Content:
Engineering Science: 3 credits or 100%

Prepared by Dr. Dennis Siginer 3/30/07
ME 533 – Mechanical Measurements

Catalog Outline: ME 533. Mechanical Engineering Laboratory (3). 2R; 3L. Introduces the basics of engineering measurements. Discusses related theory, followed by applications in such areas as strain, sound, temperature, and pressure measurements. Format includes lectures, recitation (which presents the concept of the experiment to be performed and the required data analysis), and laboratories. Analyzes the data obtained from measuring systems set up and operated in the laboratory to demonstrate and reinforce fundamental concepts of engineering mechanics. Prerequisites: ECE 282 and AE 333, each with a grade of C or better. Corequisite: ME 522.


Topics (1 class = 75 min.): (Class time on topics may vary depending on class comprehension)
Measurements Process and Units (1 class)
Assessing and Presenting Experimental Data (4)
Analog Signals: Definitions and Frequency Analysis (4)
Measurement System Response (4)
Sensors (2)
Signal Conditioning (4)
Pressure Measurement (2)
Flow Measurement (2)
Temperature Measurement (2)
Strain and Stress Measurement (2)
Motion Measurement (2)

Laboratory Exercises (1 lab = 150 min)
First Order System Response
Statistical Measurements and Analysis
Second Order System Response
Signals Measurement
Sensors Calibration
Thermal Conductivity Measurement
Temperature Measurement
Flowmeters
Flow around a Cylinder
Strain Gage Operation and Application
Acoustics or Motion Measurement
Laboratory Examination (problems and applied oral)

Assessment/Grading: The outcome will be assessed through lecture exams and tests, as well as laboratory reports and laboratory exam, and a grade will be assigned to students on the success of course outcome.

Homework (drop 1set) 10%
Tests (best 2 of 3) 40%
Final (mandatory) 20%
Labs    30%   A > 90; B > 80%, C > 70%, D > 60%

Homework and Tests:
1. A tentative total of ten homework sets will be assigned. The homework set with the lowest grade will be dropped and the grades of the remaining nine will count towards your grade. Homework assignments will be due at the beginning of class, on the date a new problem set is assigned. No credit will be given after that time. A standard homework format is to be used to obtain full credit.

A total of 3 exams will be given during the course of the class. The test with the lowest score will be dropped and the grades of the remaining two exam scores used in the overall grade.
3. The final is mandatory and will be comprehensive.
4. A prerequisites quiz will be given within the first few weeks of the class. The quiz is used to assess class preparedness from semester to semester. The quiz will be worth 10 extra credit homework points.

Communication and Team Work Skills:
This course emphasizes laboratory documentation and teamwork skills through the laboratory sessions. Each group will consist of 3 to 4 students, who will help each other with the particular experimental exercises or set-up. The laboratory experiment documentation, however, consisting of short experimental summaries and longer formal laboratory reports which are the responsibility of each student. Check Blackboard for documents on Laboratory Report Writing.

Course Outcomes and Relation with Program Outcomes: The course addresses the following program outcomes

1. Students will have an understanding of the functionality, application, and limitations of modern mechanical measurement instrumentation, and understand the need for continued learning in new instrumentation technology as it develops. (Criterion 3a, 3f, 3h)
2. Students will have an understanding of basic statistical and mathematical tools and concepts used in experimental measurement and design, understand it is independent of the technology used, and from class discussion understand about further learning opportunities in these tools. (Criterion 3a, 3b)
3. Through the lab section of the course, students will gain hands on experience in conducting various mechanical measurements and recognize safety-related ethical responsibilities in laboratory practice (Criterion 3a, 3c, 3h)
4. Through the lab section of the course students will develop individualized basic laboratory report documentation skills while participating in team-related activities (Criterion 3e)

Estimated ABET Category Content:

Engineering Science: 3 credits or 100 %

Prepared by: K. A. Soschinske       04/06/2006
ME 541  Mechanical Engineering Design II

Catalog Data: ME 541. Mechanical Engineering Design II. (3 credit). Applications of engineering design principles to the creative design of mechanical equipment. Problem definition, conceptual design, feasibility studies, design calculations to obtain creative solutions of current real engineering problems. Introduction to human factors, economics and reliability theory. Group and individual design projects. Prerequisites: ME 439.

Textbook:

Reference:

Course Objectives: The purpose of this course is to prepare the students for the professional practice of mechanical engineering design through the application of engineering fundamentals to the design of mechanical systems. The following are specific goals:
1. Appreciation of mechanical design as a continuous learning process involving more than just iterative analysis.
2. Introduction to design and analysis problems, and also use a systems approach towards mechanical design.
3. Appreciation of the importance of fatigue life prediction and tribological (lubrication and wear) issues in mechanical systems design.

Prerequisites by Topic:
1. Working knowledge of engineering science.
2. Familiarity with the philosophy of design.
3. Understanding of open-ended problems, without unique solutions.

Topics (1 class = 75 minutes):
1. Lubrication and Journal Bearings: Hydrodynamic, hydrostatic and boundary lubrication, fluid Viscosity vs. Temperature, Design considerations, Minimum film thickness, oil temperature rise, loads and other design considerations.(5 class)

2. Design of Shafts and Axles: Introduction to failure theories, Principal stresses, Fatigue considerations, design of elements subjected to multiaxial static and dynamic loads, fatigue theories, estimating reliability, introduction to stochastic design and associated probability and statistical background.(3 class)

3. Spur and Helical Gear Design: Gear nomenclature, involute properties, tooth systems, gear trains, gear force analysis, AGMA gear design procedures, gear stresses, material fatigue properties, manufacturing considerations, heat treat properties, etc.(5 class)

4. Rolling Contact Bearings: Ball, roller and tapered roller bearings, Bearing life and bearing survival using Weibull distribution, calculating catalog load ratings, bearing selection, Hertzian contact stresses, high speed bearing design considerations. (4 class)
5. Design of Bolted and Riveted Joints: Load distribution in a bolted joint, joint stiffness, bolt strength, fatigue loading, importance of preload, Goodman diagram for fatigue design, riveted joint failure modes. (5 class)

6. Clutches and Brakes: Drum and disc brakes, static analysis, energy considerations, Design examples for automobiles. (4 class)

Estimated ABET category content:
- Engineering Science: 1 credit hour
- Engineering Design: 2 credit hours

Engineering Design:
- Most assignments in the major part of the course are detailed design problems, with emphasis on a systems approach. Students are continuously introduced to machine design concepts. Most homework assignments are closely related to machine components. Design of machines and mechanical systems is a fundamental aspect of this course. Probability and statistics is integrated into the topical areas covered with the extensive use of stochastic design methods.

Written and Oral Communication Skills:
- Students are required to submit detailed written reports on design assignments.

Computer Usage:
- Students use computers in various stages of their homework assignment. Since design is inherently an iterative process, computer solutions are very advantageous in the design process. In addition, students are encouraged to utilize the standard software packages that are available and appropriate to their work. TKSolver and MATHCAD are two mathematical software packages used for solving design problems.

Relation to Program outcomes:
- A basic understanding of the principles of machine component design is an essential requirement for mechanical engineers in an industrial environment. (Criterion 3(c))
- Potential employers and graduate programs expect the students to have an ability to: Apply knowledge of mathematics, science, and engineering. (Criterion 3(a)) Design a system, component, or process to meet desired needs. (Criterion 3(c)) Identify, formulate, and solve engineering problems. (Criterion 3(e)) Communicate effectively and educate themselves. (Criterion 3(g), & (i))

Prepared by: B. Minnaie, Associate Professor    Date: 1/30/07
**ME 544 – Design of HVAC System**

Catalog Data: ME 544. Design of HVAC Systems. (3 Credit). Theory, analysis, and design of heating, ventilation, and air conditioning systems based on psychometrics, thermodynamics, and heat transfer fundamentals. Emphasis is on design procedures for space air-conditioning and heating and cooling loads in buildings.

Prerequisites: ME 621, ME 622 and ME 502.

Textbook:

Reference Book:

Instructor: Dr. T.S. Ravigururajan, Associate Professor, Mechanical Engineering, Wichita State University, EB 101D; Campus Mailbox 0133.

Course Objectives: An introduction to the terminology and analysis of HVAC Systems dealing with design procedures for space air conditioning and calculation of heating and cooling loads. The course lays stress on the following aspects:
- The use of psychometric property data;
- Problem-solving techniques based on a systematic approach to defining and analyzing given data;
- Application of the basic laws of air-conditioning and refrigeration systems to engineering sciences concerned with the production and utilization of energy.

Prerequisites by Topic:
ME 621
ME 622
ME 502

Topics: (1 Class = 75 minutes)
- Introduction to air conditioning and refrigeration systems (1 class)
- Moist air properties, psychometric process, and analyze of space air conditioning for design and off-design conditions. (6 class)
- Environmental comfort and health requirements (6 class)
- Heat transmission in building structures. (3 class)
- Solar radiation (1 class)
- Space heat load analysis. (2 class)
- Cooling load analysis. (4 class)
- Room air distribution and duct system. (4 class)
- Cooling coils and fans. (4 class)
- Examinations. (2 class)

Estimated ABET Category Content:
- Engineering Science: 2 credits or 67%
- Engineering Design: 1 credit or 33%
Engineering Design:
Assignments of open ended, design type problems may be made as part of the Homework assignments.

Computer Usage:
Students are expected use computer facilities available to them, for load calculations and word processing in their homework and design projects. Any available HVAC program should be used in solving problems and the students will use the package in their design project and in project analysis, if there is any.

Projects:
The class will be divided into several groups with 3 members each. The group will select a project of its choice. For example: A multi-storied building such as Wallace Hall high school building, or a proposed manufacturing plant (specify your own plant), an aircraft, submarine, etc. The bids to design and install a modern air conditioning system on a turnkey basis should be prepared and submitted with the relevant information.

Relation to Program outcomes:
A basic understanding of theory, analysis, and design of heating, ventilation, and air conditioning systems based on psychometrics, thermodynamics, and heat transfer fundamentals is an essential requirement for mechanical engineers entering any field of industry. (Criterion 3 (c) & (k)) Potential employers and graduate programs expect the students to:
Have clear concepts of the basic principles of heating, ventilation, and air conditioning and its terminology. (Criterion 3 (c))
Ability to solve engineering problems. (Criterion 3 (e))
Apply their knowledge of mathematics, science, and engineering in solving practical problems and critically review their own work. (Criterion 3 (a) & 3 (c))
Be able to communicate the results of their analysis in a meaningful and useful way, understand ethical responsibility, have knowledge of contemporary issues and educate themselves. (Criterion 3 (f), (g), (i) & (j))

Prepared by: T.S. Ravigururajan, Associate Professor      Date: 1/30/07
ME-631 Heat Exchanger Design

Catalog Data: ME 631. Heat Exchanger Design. (3 Credit). This course covers analytical models for forced convection through tubes and over surfaces, experimental correlations for the Nusselt number and pressure drop; design of single and multiple pass shell and tube heat exchangers; compact baffled, direct contact, plate, and fluidized bed heat exchangers; radiators, recuperators, and regenerators. Prerequisites: ME 521 and ME 522 or equivalent. Pre-requisites by Topic: Fluid mechanics/heat transfer principles relating to 1. Forced convection and 2. Internal and External Fluid Flow


Afghan and Schlunder, Heat Exchanger Design and Theory
Ginoux, J.J., AGARD Lecture on Heat Exchangers

Course objectives: To familiarize with the fundamentals of the heat transfer theory associated with heat exchanger, and to apply the thermal design procedures in the actual design of a variety of heat exchangers commonly used in the industry.

Introduce students to the concepts behind thermal modeling and their relation to heat transfer/fluid mechanics principles and concepts.
Teach students the skill to analyze a heat exchanger design and identify the controlling parameters.
Learn to apply the basic concepts from prerequisites in designing the appropriate heat exchanger.
Develop skills to seek and substitute necessary information to integrate the heat exchangers with other system components such as pumps, valves, and turbines.
Place emphasis on open-ended and broadly defined problems and the iterative solutions to design problems.
Provide students an opportunity to work on team projects that reflect practical design problems.
Require students to treat design problems comprehensively: definition and development of problem, solution and analysis, identification and recommendation of appropriate equipment for clientele, based on requirement and cost.

Topics (1 class = 75 minutes)
Heat and fluid Mechanics review (2 classes)
Design considerations and approaches (2 classes)
LMTD and NTU Methods (4 classes)
Double-Pipe HX (2 classes)
Boiling/Condensation Design Correlations (2 classes)
Shell and tube heat exchangers (4 classes)
Mechanical design of heat exchangers (2 classes)
Compact heat exchangers (2 classes)
Plate HX (2 classes)
Evaporators and Condensers (4 classes)
Miscellaneous Topics (1 class)
Tests (3 classes)

Engineering Design:
The students will be assigned open-ended problems as homework on a regular basis. They
will be divided into groups of 3 or less who will then select a suitable design project of their
interest. The group is responsible for project definition, execution, analysis, and report
preparation. The student projects will be periodically monitored through group discussion with
the faculty.

Written and Oral Communication:
The students are expected to submit a project report at the end of the semester. The report is
to be prepared in a professional manner utilizing available word processors, spreadsheets, and
other graphic programs.

Ethical, Social, Economic, and Safety Considerations:
Ethical and social considerations are discussed as part of lectures on thermal comfort.
Economic considerations are treated as part of the project work. Safety considerations are
discussed during lectures with focus on proper design, adherence to ASME and TEMA codes,
and their impact product quality and probable litigation.

Project:
The students will work on a group project (3 per group) and design an assigned heat
exchanger for an application. The performance and cost analysis should be included in the
design. The students will use ‘C’ language in developing a general-purpose program that will
design the same type of heat exchanger considered in the project. The program will be used to
confirm the results obtained.

Estimated ABET Category Content:
Engineering Design: 3 credits or 100 %

Relation to Program outcomes:
A basic understanding of heat exchanger design is an essential requirement for mechanical
engineers entering any field of industry. (Criterion 3 (c) & (k))
Potential employers and graduate programs expect the students to:
Have clear concepts of the basic principles of thermodynamics and its terminology. (Criterion 3
(e))
Apply their knowledge of mathematics, science, and engineering in solving practical problems
and critically review their own work. (Criterion 3 (a) & 3 (c))
Be able to communicate the results of their analysis in a meaningful and useful way, understand
ethical responsibility, have knowledge of contemporary issues and educate themselves.
(Criterion 3 (f), (g), (i) & (j))

Prepared by: T.S. Ravigururajan, Associate Professor     Date: 1/30/07
ME 633 – Mechanical Engineering Systems Laboratory

Catalog Data: ME 633. Mechanical Engineering Systems Laboratory (3 credits). 2R, 3L. Selected experiments illustrate the methodology of experimentation as applied to mechanical and thermal systems. Experiments include the measurement of performance of typical systems and evaluation of physical properties and parameters of systems. Group design and construction of an experiment is an important part of the course. Team and individual efforts are stressed as are written and oral communication skills. Prerequisites: ME 533, ENGL 102.


Course Objectives:
Give students additional knowledge and experience in the design and performance of experiments involving the operation of thermal and mechanical systems. Develop the student's communications skills with a strong emphasis on oral presentation in the style of engineering technical conference presentations. Provide a realistic project team experience in the design and development of an experiment for instructional use in mechanical engineering.

Prerequisites by Topic:
1. Laboratory measurement and instrumentation
2. Statistical analysis
3. Thermal and Fluid Science
4. Statics and strength of materials

Topics (One class period = 50 minutes):
1. LabVIEW introduction (2 classes)
2. Design of data acquisition systems (National Instruments/LabVIEW) (4 classes)
3. Discussion of oral technical presentations. (1 class)
4. Discussion of team building and organization (1 class)
5. Laboratory safety (1 class)
6. Background material for experiments. (5 classes)
7. Formal technical presentations (11 classes)
8. Student project. (5 classes)

Laboratory Projects: (1 laboratory period = 150 minutes):
During the course of the semester there are seven primary laboratory activities that extend over nine (10) laboratory periods. Remaining laboratory periods allow lab groups to develop technical presentations and do teamwork on design projects. The seven primary laboratory activities are divided into two groups: 1) Modular LabVIEW training activities and a LabVIEW data acquisition exercise, and 2) Five laboratory experiments (e.g., pump performance and affinity laws, diesel engine performance tests, diesel engine cylinder pressure history, bomb calorimetry (diesel fuel), factorial test planning dealing with the statistical significance of factors (ANOVA). The LabVIEW based activities require individual submission of programs known as Virtual Instruments (VI). The experiments require group presentation of results in five, two-day seminars. Powerpoint presentations are submitted. The semester long student design effort is described below.

Engineering Design: The semester project is considered an important engineering design
problem. Each student group is then assigned a project that needs to be done in one of the mechanical engineering laboratories or classes. They are given the need and application for the project and must conceive an acceptable experiment idea that can be built within cost and time constraints. They are also told that documenting their work will be important in the successful conclusion of the project. The project is assigned at the beginning of the semester and students are to use laboratory time not assigned to other experiments to design built and debug their experiment.

Application of Statistics: Every experiment requires statistical analysis of data (small population statistic to determine confidence intervals using Student-t distribution with application of Chauvenet’s criterion.) One entire experiment is devoted to the use of ANOVA as an engineering tool to identify important factors in the design of experiments and in analyzing the results.

Computer Usage: There is a strong emphasize on the use of LabVIEW programming for data acquisition throughout the course. All presentations are done using MS PowerPoint, with word-processing and spreadsheet software used in preparation efforts.

Written and Oral Communication Skills: Student must prepare professional caliber engineering presentations requiring: written proficiency in the preparation of comprehensive MS PowerPoint presentation materials, and that emphasizes oral communication skills. Each laboratory team is required to give four group oral presentations on four of the five experiments. Additional short reports are required for communication about the semester long design project.

Ethical, Social, Economic, and Safety Considerations: Student teams are selected to provide a mixture of people from different backgrounds and cultures. As with any laboratory, specific safety instructions and guidelines are given for operating the experiments. Students are also required to make safety a major consideration in designing an experiment that will be used by inexperience users, some of whom aren't even interested in the experiment.

Estimated ABET Category Content:
Engineering Science: 1 credits or 33%
Engineering Design: 2 credits or 66%

Relation to Program outcomes:
Fundamental knowledge of experimental techniques and their application in mechanical systems are essential for engineers working in this field. (Criterion 3 (a))
Potential Employers and graduate program expect the students to have the ability to:
Apply knowledge of experimental design, use of instrumentation, measurement techniques, and data acquisition and reduction. (Criterion 3 (a) & (b))
Identify, formulate and solve experimental design problems. (Criterion 3 (b))
Communicate effectively, work in a team and understand ethical responsibility. (Criterion 3 (d), (f) and (g))
Use techniques and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: D. N. Koert, Associate Professor      Date: 1/30/07
ME 637 – Computer Aided Engineering

Catalog Data: Elective Course: 3 credits, Computer-Aided Engineering (3). 2R, 3L. Integrates computer-aided design, finite element analysis, kinematics analysis and other considerations for design of mechanical components and systems. Provides a blend of theory and practice. Prerequisite: ME-439, Undergraduate students, who have not taken this course before, MUST drop the course.

Objective: The objective of this course is for senior engineering and beginning graduate students to learn the fundamentals and applications of 3D CAD systems, solid modeling and geometric tolerance and finite element analysis which can be integrated across various aspects of the product development process.


Graduate Students: Graduate students are expected to do graduate level work throughout the semester. Final Project done by a graduate student should be more comprehensive and in-depth.

Note: Use Blackboard through www.wichita.edu as much as possible. This applies to students as well as instructor. Instructions on the Final Project will be given after the first half of this semester. Lectures are not for teaching the software. They are just to explain the CAD systems.

Project: The project should be an original model. It should be fully constrained. Do not bring up drawings from workplace, company or any other property drawings. However if you work with a particular part often and can draw it from memory, that will be acceptable. Clear all projects with me before starting and make sure you allow enough time to complete the model by end of semester.

Topics: (1 class = 75 minutes)
Three dimensional modeling (5 classes)
3D Modeling
Geometric modeling of curves-Bezier
Geometric modeling of curves-Hermit cubic Spline & B-Spline – Review
Introduction to surfaces and analytical surfaces
Synthetic surfaces
Quiz #1-Solution of Quiz #1 (1 class)
Quiz #1-Solution of Quiz #1
MATLAB Programming (1 class)
Introduction to MATLAB
Geometric modeling of solids (1 class)
Geometric modeling of solids and solid manipulation
Transformations (2 classes)
Rotation and translation and scaling
More about rotation and translation and scaling and applying transformation on the parts
Assembly Modeling (1 class)
Introduction to assembly modeling and different approaches in assembly
Quiz #2-Solution of Quiz #2 (1 class)
Quiz #2-Solution of Quiz #2
Engineering Tolerances (1 class)
Engineering Tolerances
Geometrical Dimensioning & Tolerances (2 class)
Features in geometric modeling (including GD&T)-1
Features in geometric modeling (including GD&T)-2
Assignment of the course projects (1 class)
Project
Mid-term Exam (Theory) (1 class)
Mid-term Exam (Theory)
Parametric design of gears (2 classes)
Introduction to gears and involute curve
Parametric design of gears’ tooth profile
Mass properties (1 class)
First and second moments of inertia
Finite element analysis (3 class)
Introduction to finite element method
Finite element method-1
Finite element method-2
Quiz #3-Solution of Quiz #3 (1 class)
Quiz #3-Solution of Quiz #3
CAM using part programming (2 class)
Introduction to NC and CNC machines
CNC programming
Kinematics (2 class)
Planar kinematics
Spatial kinematics
Project time (2 class)
Project
Review (2 class)
Review

Relation to Program outcomes:
A basic understanding of course topics is essential requirement for mechanical engineers entering any field of industry. (Criterion c and e and k)
Students need to submit a report for their project to be familiar with the methods of data collection and expressing that in a standard format which is understandable for others. (Criterion c and g)
Students are expecting to apply their knowledge of mathematics, science, and engineering in solving practical problems and critically review their own work. (Criterion a and c)
Students need to understand the responsibility and safety issues in their designs. (Criterion f)

Prepared by: Behnam Bahr Professor Date: 1/30/07
ME 639 Applications of Finite Element Analysis in Mechanical Engineering

Catalog Description:
Elective Course. 3 Credits. Introduces the finite element method (FEM) as a powerful and general tool for solving differential equations, arising from modeling practical engineering problems. Finite element solutions to one- and two-dimensional mechanical engineering problems in fluid mechanics, heat transfer, solid mechanics, and vibrations. Includes Galerkin's and variational finite element models. Introduces commercial finite element analysis software ANSYS.

Prerequisites:
ME 439 and 522 with a grade of C or better, or equivalent.

Textbook:

Course Objective:
Design and analysis of basic machine components using finite element method.

Instructor: Dr. Bob Minaie
Office: 101-P Engineering Building
Phone: 316-978-5613, E-mail: bob.minaie@wichita.edu
Office Hours: TW 11 a.m.-12 p.m. or by appointment

Topics (1 class = 75 min.):

1. Matrix Algebra and Introduction to Stiffness Method (5 class)
2. Element Formulation, Boundary Conditions, Applied Forces, and Output Interpretations of:
   Truss Elements (3 class)
   Beam and Frame Elements (4 class)
   Two-Dimensional Solid Elements (4 class)
   Axisymmetric Elements (3 class)
   Three-Dimensional Solid Elements (3 class)
   Plate and Shell Elements (4 class)
3. Heat Transfer and Thermal Stress Analysis (3 class)
4. Examinations (2 class)

Computer Software:
Students use commercial finite element analysis software ANSYS.

Course Outcomes and Relation with Program Outcomes:
The course addresses the following program outcomes:
an ability to apply knowledge of mathematics, science, and engineering
an ability to design a system, component or process to meet desired needs
an ability to identify, formulate, and solve engineering problems
an understanding of professional and ethical responsibility
an ability to communicate effectively
a recognition of the need for, and an ability to engage in life-long learning
a knowledge of contemporary issues
an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Estimated ABET Category Content:
  Engineering Science: 2.5 credits or 84 %
  Engineering Design: 0.5 credit or 16 %

Prepared by: Bob Minaie 08/16/2006
**ME 659  Mechanical Control**

Catalog Data:


Coordinator: B. Bahr, Professor, Mechanical Engineering.

Course objectives: This course provides the students with the fundamentals of classical linear system analysis and control design. The course will enable the student to:

- Develop a mathematical model of a physical system and use Laplace Transforms to find the system transfer function.
- Analyze the stability and time response of a 2nd order and higher order physical systems.
- Use design tools such as the Routh-Hurwitz Criterion, root locus plots, Nyquist plots and steady state error analysis to design output feedback control systems.
- Understand and design PID and phase lead/lag control systems.

Prerequisites by topic:
1. Differential Equations including an introduction to Laplace Transforms.
2. Basic electrical circuit theory.
3. Prior exposure to modeling and analysis of simple mechanical systems.

Topics: (1 class period is 50 minutes):
1. Introduction. (1 period)
   - Open loop control and closed loop control.
2. Mathematical Background. (6 periods)
   - Laplace transformation
   - Inverse Laplace transformation
   - Solution of linear differential equation by the Laplace transform method
   - Brief introduction to state space method
3. Mathematical models for physical system. (6 periods)
   - Transfer functions
   - Block diagram
   - Feedback Control
   - Transfer functions of physical systems
4. Time Domain Analysis. (6 periods)
   - System Stability
   - Steady State Error
   - Transient System Response
   - Second order systems
   - Routh's stability criterion
5. Root Locus Method for Analysis and Design. (7 periods)
   - Root locus plots
- Computer Root-locus
  Root locus analysis of control systems
  Design of controller using Root locus method
6. Time Domain Design of a Controller. (7 periods)
  Design of a PID controller
- Design of a Phase Lead-Lag Controller
7. Frequency Response Methods for Analysis and Design. (7 periods)
  Nyquist Plots
  Nyquist Gain and Phase Margin Stability
  Bode Gain and Phase plots
8. Examinations. (3 periods)

Computer Usage: Many textbook problems are solved throughout the semester using MATLAB control toolbox routines to plot system time-response and develop Root Locus, Nyquist and Bode plots for the design of different controllers.

Engineering Design: The design portion is integrated into the last 15 periods (approximately 1/3 of the course) where the students are taught how to design various compensators by using design tools including the MATLAB controls toolbox routines. Included are several homework problems leading up to a design project in which the student is given a physical system and asked to choose and design a controller to meet certain system response goals.

Written and Oral Communication Skills: The final design project requires a short (2 page) report detailing the design process the student used to achieve the final design and a justification and "sales" write-up as to why that particular design was chosen as best. Correct use of English is part of the grade.

ABET category content as estimated by faculty member who prepared this course description:
Engineering science: 2.5 credits or 83%
Engineering design: 0.5 credits or 17%

Relation to program outcomes:
A basic understanding of Theory and analysis of the dynamic behavior of control systems, based upon the laws of physics and linear mathematics is an essential requirement for mechanical engineers. (Criterion 3 (c))
Potential employers and graduate programs expect the students to have an ability to:
Apply knowledge of mathematics and science. (Criterion 3(a))
Identify, formulate, and solve engineering problems. (Criterion 3 (e))
Communicate effectively. (Criterion 3 (g))
Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: Brian Driessen, Assistant Professor  Date: 1/31/07
**ME 662 – Mechanical Engineering Practice**

Catalog Outline: ME 662. Mechanical Engineering Practice, 3. An exercise in the practice of mechanical engineering; students engage in a comprehensive design project requiring the integration of knowledge gained in prerequisite engineering science and design courses. Team effort and both oral and written presentations are a part of the experience. Prerequisite: mechanical engineering students in their last semester of study. Prerequisites: Mechanical engineering students in their last semester of study.

Instructor/Coordinator: Dr. Kurt Soschinske, Rm. EB 102, 978-6388. kurt.soschinske@wichita.edu

Office Hours: As posted; e-mail: kurt.soschinske@wichita.edu; Tel: 978-3402

References:

Topics (1 class = 75 min.):
1. Introduction to class; Describe industrial projects & fill out student skill/project interest forms (1 class)
2. Assign students to teams, teams to projects. Introduction to project management (1 class)
3. Engineering Design in Practice (1 class)
4. Design Optimization & Design Calculations using Excel (1 class)
5. Global Learning and Collaborations (3+ classes)
6. Ergonomics in Mechanical Engineering Practice (1 class)
7. Safety in Mechanical Engineering Practice (1 class)
8. Product Liability (1 class)
9. Patents in Mechanical Engineering (1 class)
10. Entrepreneurship (1 class)
11. Ethics, Professional Practice and Licensing ( 2 class)
12. Effective Presentations lecture; Oral Reports (4+ classes)
13. Final Oral Report Dry Run and Final Oral Report presentation (1 class; 1 morning to noon session)
15. Open House Poster Presentations (all day April 20th, COE sponsored event for all engineering)
16. Open Class Periods for vendor contact and full group project work (4 classes)
17. Examinations (Finals time slot)
* Videos include Introduction to Contracts, ASME Standards, Engineering Disasters (History Channel)

In addition, outside lectures are recommended from WSU ME Lecture Series and COE Bloomfield Lecture Series. For Spring 2007 ME Lecture Series talks include Global Engineering, ITAR Issues in Global Collaborations, while the Bloomfield Lecture discusses Sustainability in Engineering. Many lectures are taught by invited guest speakers from industry with extensive experience and knowledge. Lecture topics may change due to speaker availability.
For invited speakers, students in each group rotate the task of writing a one to two page lecture summary of the presentation. Each group shall have one lecture summary for each guest speaker. Attendance is taken as part of class participation.

Assessment/Grading:
Grades will be determined by the following formula:
- E-mails to instructor and sponsor* – 4%
- Guest Lecture Summaries and Global Learning Logs* – 4%
- Oral reports* (4) -- 16%
- Written progress reports* (3) -- 12%
- Final written report* -- 10%
- Project poster* -- 4%
Instructor's assessment** -- 20%
- Project Sponsor's evaluation** -- 20%
- Final Examination of Mechanical Engineering Skills – 10% (Required for course completion)

* Individual grade will be group grade multiplied by peer assessment
** Project /group grade

A > 90; B > 80%, C > 70%, D > 60%

For more details on oral reports, written reports, final written reports, project poster, and final examination, see the Blackboard Course Content Section.

Course Outcomes and Relation with Program Outcomes: The course addresses the following program outcomes

a) an ability to apply knowledge of mathematics, science, and engineering
b) an ability to design a system, component or process to meet desired needs
c) an ability to function on a multi-disciplinary team
d) an ability to identify, formulate, and solve engineering problems
e) an understanding of professional and ethical responsibility
f) an ability to communicate effectively
g) the broad education necessary to understand the impact of engineering solutions in a global and social context
h) a recognition of the need for, and an ability to engage in life-long learning
i) a knowledge of contemporary issues
j) an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Estimated ABET Category Content:
Engineering Science: 3 credits or 100 %

Prepared by: K.A. Soschinske 04/06/2007
ME 664 – Introduction to Fatigue and Fracture

2006 2008 Catalog Data:
ME 664 – Introduction to Fatigue and fracture. 3 Credits: Deals with the primary analytical methods used to quantify fatigue damage. These are the stress life approach, strain life approach, and the fracture mechanics approach. Prerequisites: ME 250 and AE 333.

Text Books:

Coordinator: G. E. Talia, Professor.

Reference Books:

Course Objectives: This course is designed to give students knowledge about fatigue analysis methods. The information and background obtained in this course will enable the students to become proficient at these analytical methods in an effort to design against fatigue damage. Student were expected to gain and show that they possessed:
A basic understanding of Fatigue analysis methods.
An ability to apply the knowledge of mathematics, science and engineering.
An ability to solve engineering problems.
Ability to design against fatigue damage.
An ability to communicate effectively and work in a group.
An ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by Topic:
Materials Engineering.

Topics: (1 class = 75 minutes)
Fracture Mechanics (4 classes)
Stress Life (4 classes)
Strain Life (4 classes)
Notches (4 classes)
Variable Amplitude Loading. (4 classes)
Comparisons of Methods. (2 classes)
Multiaxial Fatigue (3 classes)
Exams and Presentations. (4 classes)

Written and Oral Communications Skills:
Written reports are required from each student describing the results of their fatigue and fracture project. Teams are used on projects. Presentation of projects in class is required.

Computer Usage:
None specifically assigned. Students are encouraged to use the necessary software to
search for materials for their project. Also the project is required to be prepared using a computer.

Project:
   Students work on a project or case study relating to fatigue and fracture.

Estimated ABET Category Content:
   Engineering Science: 3 credits or 100 %

Relation to program outcomes:

A basic understanding of material toughness, design stress and allowable flaw size is an essential requirement for design engineers. (Criterion 3 (c))
Potential employers and graduate programs expect the students to have an ability to:
   Apply knowledge of mathematics, science and engineering. (Criterion 3 (a))
   Identify, formulate, and solve engineering problems. (Criterion 3 (e))
   Communicate effectively. (Criterion 3 (g))
   Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: G.E. Talia, Professor

Date: 02/01/07
ME 665: Selection of Materials for Design and Manufacturing

2006-2008 Catalog Data:
ME 665: Selection of Materials for Design and Manufacturing: 3 Credits. Focus on the selection of engineering materials to meet product and manufacturing requirements. Solutions to various product and manufacturing problems by appropriate selection of materials are illustrated through the use of numerous examples and case studies.

Textbook: Not required.

Reference Books:

Coordinator: G.E. Talia, Associate professor of Mechanical Engineering.

Course Objectives: The objectives and goals are to present as well rounded study as possible: definition and /or description of the case, establishment of service conditions, presentation of theory governing the problem, consideration relevant to the selection of suitable materials, candidate materials choices, and a final evaluation of these materials. The most important purpose is the understanding of the real life conditions in the design processes evaluation of the student a written recommendation of each case will be requested. Then the course will focus on the development of independent answers and in the latest development in the field of engineering materials. Students were expected to gain and show that they possessed:
A basic understanding of selection of materials for a design component.
An ability to apply the knowledge of mathematics, science and engineering.
An ability to solve engineering problems.
An ability to select material for a design component.
An ability to communicate effectively and work in a group.
An ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by Topic: All students are expected to have backgrounds in chemistry, physics, math, thermodynamics, mechanics of solids, and at least some introduction to materials in undergraduate engineering courses.

Topics (1 class = 75 minutes)
Energy case study. (4 classes)
Structural Case Study. (7 classes)
Shielding Case Study. (5 classes)
Transporting Case Study. (4 classes)
Radiation Case Study. (3 classes)
Mechanical Case Study. (4 classes)

Written and Oral Communications Skills:
Written reports are required from each student describing the results of their case study relating to material selection. Teams are used on projects. Presentation of projects in class is required.
Computer Usage:
None specifically assigned. Students are encouraged to use the necessary software to search for materials for their project. Also the project is required to be prepared using a computer.

Estimated ABET Category Content:
Engineering Science: 3 credits or 100 %

Relation to program outcomes:
A basic understanding of material toughness, design stress and allowable flaw size is an essential requirement for design engineers. (Criterion 3 (c))
Potential employers and graduate programs expect the students to have an ability to:
Apply knowledge of mathematics, science and engineering. (Criterion 3 (a))
Identify, formulate, and solve engineering problems. (Criterion 3 (e))
Communicate effectively. (Criterion 3 (g))
Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: G. E. Talia, Professor Date: 02/01/07
ME 666 – Manufacturing with Materials

This course gives information about manufacturing processes and underlying principles.
Prerequisites: ME 250 or Departmental Consent.


Coordinator: G.E. Talia, Professor of Mechanical Engineering.

Course Objectives: This course is designed to give students a basic understanding and knowledge of principles that can be used to understand and improve existing manufacturing processes and create new ones. Students were expected to gain or show that they possessed

1. a basic understanding of manufacturing processes.
2. an ability to apply the knowledge of mathematics, science and engineering.
3. an ability to solve engineering problems.
4. an ability to improve existing manufacturing processes.
5. an ability to communicate effectively and work in a group.
6. an ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by topic:
1. Materials Engineering

Topics (1 class period is 75 minutes):

1. Metal Casting. (5 periods)
2. Bulk deformation processes. (5 periods)
   Open die forging. Impression die and closed die forging. Extrusion. Drawing. Rolling
3. Sheet Metal Working Processes. (5 periods)
4. Powder metallurgy. (4 periods)
   Powder consolidation. Sintering and finishing. Hot compaction
5. Processing of Ceramics. (3 periods)
   Processing of particulate ceramics. Processing of glasses
6. Processing of plastics. (5 periods)
7. Machining. (2 periods)
8. Project Presentation (2 periods)
9. Examinations. (3 periods)

Written and Oral Communications Skills: Written homework and exams are required from each student.
Computer Usage: None specifically assigned. Students are encouraged to use the necessary software to search for materials for their project.

Estimated ABET Category Content:
Engineering Science: 3 credits or 100%

Relation to program educational objectives:

1. A basic understanding of manufacturing processes is an essential requirement for engineers working in that area.
2. Potential employers and graduate programs expect the students to have an ability to:
   - Apply knowledge of mathematics, science and engineering.
   - Identify, formulate, and solve engineering problems.
   - Communicate effectively.
   - Use techniques, skills, and modern engineering tools necessary for engineering practice.
ME 667 – Mechanical Properties of Material

2006-2008 Catalog Data:
ME 667. Mechanical Properties of Materials. 3 Credits. Major focus is on deformation mechanisms and on crystal defects that significantly affects mechanical properties. Also covered is plasticity theory, yield criteria for multi-axial states of stress, fracture mechanics, and fracture toughness. Some review of basic mechanics of materials and elasticity is included as needed. Prerequisites: ME 250 or Departmental Consent.

Text Book: Mechanical Metallurgy, George E. Dieter, Third Edition

Coordinator: G. E. Talia, Professor.

Course Objectives: The major goal of this course is to relate the engineering mechanical properties of materials to the metallurgic and microscopic characterization of those materials. Students were expected to gain or show that they possessed:
A basic understanding of mechanical properties of materials, and metallurgic and microscopic characterization of those materials.
An ability to apply the knowledge of mathematics, science and engineering.
An ability to solve engineering problems.
An ability to communicate effectively and work in a group.
An ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by topic:
Chemistry
Differential Calculus.
Introductory course in Materials Engineering.

Topics: (I class = 75 minutes.)
Crystallographic Structure in Materials.(2 period)
Tensile Behavior in Materials.(7 period)
Stress strain relationship.
Engineering vs. true stress-strain properties.
Types of failures.
Fatigue and Fracture. (4 periods.)
Concept of S-N curve.
Low fatigue vs. high cycle fatigue.
Fractographic overview on different kinds of fractures. Determine crack origin and counting crack growth rates from fatigue striations. Uniform cyclic loading vs. spectrum loading and its effect on fatigue.
Fracture toughness. (2 periods.)
Concept of plain strain fracture toughness vs. plain stress fracture toughness.
ASTM E399 test method for determining KIC.
Validity of KIC test.
Hardness, Compression and Bearing properties of Materials.(3 periods.)
Reviews, Exams, and project presentations.(11 periods.)

Written and Oral Communications Skills:
Written reports are required from each student describing the results of their project relating to mechanical properties of material. Teams are used on projects. Presentation of projects in class is required.

Computer Usage:
None specifically assigned. Students are encouraged to use the necessary software to search for materials for their project. Also the project is required to be prepared using a computer.

Project:
Students work on a project on case studies of mechanical properties of material.

Estimated ABET Category Content:
Engineering Science: 3 credits or 100 %

Relation to program outcomes:
A basic understanding of mechanical properties of materials, and metallurgic and microscopic characterization of those materials is an essential requirement for the engineers working in this field. (Criterion 3 (c))
Potential employers and graduate programs expect the students to have an ability to:
Apply knowledge of mathematics, science and engineering. (Criterion 3 (a))
Identify, formulate, and solve engineering problems. (Criterion 3 (e))
Communicate effectively. (Criterion 3 (g))
Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: G.E Talia, Professor       Date: 01/10/07
ME 669  Acoustics

2000-2001 Catalog Data:
ME 669  Acoustics. (3 Credits). Fundamentals of acoustics including the study of simple
harmonic systems, acoustic waves, transmission phenomena, environmental and architectural
acoustics. Prerequisites: Math. 555 and AE 373. Prerequisites by topic: Differential equations
and introductory dynamics.


Coordinator: Kurt Soschinske, Assistant Professor of Mechanical Engineering

Course objectives: To introduce the fundamental concepts of simple vibrating mechanical
systems leading to the vibration of air as acoustic waves. The student is exposed to applications
of these concepts including architectural acoustics, sources of desirable and undesirable noise,
and human perception of noise.

Topics:(1 class period is 50 minutes):
1. Introduction to simple harmonic motion (5 classes)
   - Mass spring damper system
   - Transient response and forced oscillation
   - Resonance and Fourier analysis.
2. Vibrating strings (7 classes)
   - 1D wave equation
   - Reflection, forced vibration
   - Finite length string
3. Acoustic waves (8 classes)
   - Derivation of the wave equation
   - Speed of sound, energy, acoustic intensity, impedance
   - Decibel scales, Spherical waves
4. Wave transmission and reflection, normal and oblique incidence (3 classes)
5. Human perception of sound (6 classes)
   - Weighted sound levels
   - Speech privacy, interior noise criteria
   - Exterior noise, highway and aircraft noise
6. Architectural acoustics (6 classes)
   - Enclosures
   - Reverberation time
   - Sound absorption in rooms
   - Architectural acoustic design
7. Pipes and ducts (1 class)
8. Projects (2 classes)
9. Exam (3 classes)

Engineering Design: An open ended project is typically assigned in which the students are to
acoustically treat a room to achieve, as close as possible, a specified reverberation time over a large frequency range. A report is required in which the types of materials used are detailed along with their effect on the acoustics and a cost estimate for the treatment.

Written and Oral Communication Skills: A report is required for a design project in which the types of materials used are detailed along with their effect on the acoustics and a cost estimate for the treatment.

ABET category content as estimated by faculty member who prepared this course description:

- Engineering science: 3 credits or 100%
- Engineering design: 0 credit
- Other: 0 credit

Relation to program outcomes:
A basic understanding of acoustics including the study of simple harmonic systems, acoustic waves and transmission phenomena is an essential requirement for aerospace and mechanical engineers. (Criterion 3 (c))
Potential employers and graduate programs expect the students to have an ability to:
- a) Apply knowledge of mathematics and science. (Criterion 3 (a))
- b) Identify, formulate, and solve engineering problems. (Criterion 3 (e))
- c) Communicate effectively. (Criterion 3 (g))
- d) Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: Kurt Soschinske, Assistant Professor

Date: 1/30/07
2000-2001 Catalog Data: ME 719. Basic Combustion Theory. (3 Credits). Introduction to the fundamental principles of combustion processes. The chemistry and physics of combustion phenomena, i.e., detonation and flames, explosion and ignition process will be examined. Prerequisites: Chem 211 & ME 502.


Coordinator: David N. Koert, Associate Professor of Mechanical Engineering

Course Objectives: Review expands on and merges elements from the three major disciplines, which are most relevant to the study of combustion, i.e., chemistry, thermodynamics, and heat transfer. Introduce the main results and technologically useful topics in combustion from physical reasoning and dimensional analysis rather than solely from detailed mathematical analysis. Student were expected to gain and show that they possessed:

A basic understanding of combustion theory.
An ability to communicate effectively in a group.
Knowledge of contemporary issues.
An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by topic:
1. Differential and integral calculus
2. Thermal and molecular properties of matter
3. The Laws of Thermodynamics
4. Basic principles of general chemistry
5. Fluid dynamics
6. Heat transfer

Topics: (1 class period is 50 minutes)
Review of Chemistry and Physics (10 periods)
Chemical Thermodynamics (12 periods)
Chemical Kinetics (10 periods)
Premixed Flames (6 periods)
Ignition (6 periods)
Modern Measurements in Combustion (2 periods; student presentations)
Examinations (2 periods)

Computer use: The NASA Lewis computer program for calculating complex chemical equilibria, known as CET93 (formerly TRANS72) is featured as an important tool for technical calculations and problem solving. Licensed copies of a PC version of CET93 are distributed to the students with copies of NASA Technical bulletins documenting the program. The use of the program is taught and demonstrated using a PC equipped with screen projection. Detailed calculations of 1) chemical equilibrium composition, 2) adiabatic flame temperature, and 3)
Chapman-Jouguet detonation are explored. Homework problems and projects are assigned which require the use of the program.

Written and Oral Communication Skills: Each student is required to write a term paper on modern measurements in combustion and to give an oral presentation of the paper. The entire project accounts for 30% of the course grade, 20% for the paper and 10% for the oral presentation.

Ethical, Social, Economic and Safety Considerations: A portion of a lecture (40 minutes) is devoted to an interactive class discussion focusing on fuel as a finite resource. A list of conflicting requirements constraining selection of energy sources is presented to the class. The class is asked to highlight and discuss the constraints that are the most critical in their home towns/countries.

Estimated ABET Category Content:

Engineering Science: 3 credits or 100%
Engineering Design: 0 credits

Relation to Program outcomes:
Students acquire and apply fundamental knowledge of the science and mathematics essential for engineers working in this field. (Criterion 3 (a))
Students enhance their ability to identify, formulate and solve engineering problems. (Criterion 3 (e))
Students enhance their ability to communicate effectively. (Criterion 3 (g))
Students use computational tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: David N. Koert, Associate Professor    Date: 5/30/01
ME 729 - Computer Aided Analysis of Mechanical Systems

2006-2008 Catalog Data: ME 729. Computer Aided Analysis of Mechanical Systems. (3 credits). Modeling and analysis of planar motion for multibody mechanical systems including automatic generation of governing equations for kinematics and dynamic analysis, as well as computational methods and numerical solutions of governing equations. Computer Applications. Open-ended student projects in engineering applications such as mechanism design and vehicle dynamics. Prerequisites: AE 373, ME 339, and Math 555. Prerequisites by topic:
1. Fundamentals of statics, kinematics, and kinetics
2. Elements of machine design and dynamics
3. Ordinary differential equations


2. Notes by H. Lankarani

Course Objectives: This course is designed to introduce the students to the latest developments in the integration of computers in the analysis and design of simple to complex mechanical systems. The course aims to provide:
A bridge between the classical decision making process by an engineer.
An acquaintance with emerging technology computers and software.

Topics: (1 class =75 minutes)
1. Basic concepts in kinematics. (3 classes)
Coordinate-partitioning and appended-driving constraint methods.
2. Numerical solution of systems of linear and nonlinear equations. (3 classes)
3. Planar kinematics using Cartesian coordinates. (3 classes)
Kinematic constraints, Jacobian, and right-hand-side acceleration formulation for variety of joints such as revolute, translational, gear, and cam-followers.
4. KAP -- a FORTRAN program for analysis of planar kinematics. (2 classes)
Program description, computer simulations.
5. Kinematics modeling and kinematics projects. (3 classes)
Use of the kinematics program in mechanical system design.
6. Basic concepts in planar dynamics using Cartesian coordinates. (4 classes)
Formulation of equations of motion, vector of applied forces, spring-damper-actuators, Lagrange multipliers and reaction forces at the joints.
7. Static balance forces and kineto-static analysis. (2 classes)
8. Computational methods for solving ordinary differential equations coupled with nonlinear algebraic equations. (2 classes)
Direct-integration algorithm, Euler's and Runge-Kutta methods. Program development.
9. DAP -- a FORTRAN program for analysis planar dynamics. (2 classes)
Program description, usage, simulations, pre- and post-processing, program expansions.

10. Dynamics modeling and dynamics projects. (3 classes)
    Use of the dynamics program in mechanical system design.

11. Other topics. (2 classes)
    Vehicle modeling, kineto-static modeling, multibody modeling of structural deformation, plastic hinge modeling technique, stress and failure analysis.

12. Tests and Oral presentations. (4 classes)

Computer Usage: Students are exposed to programs for analysis and design of multibody mechanical systems. These include two large-scale codes KAP and DAP, a Windows-based graphical simulation program, as well as commercial codes such as Working Model and ADAMS. The students learn how to set up models for different mechanical systems, how to use the program with the data collected, and how to write for extending the programs for particular applications. The students use the programs throughout the course for both their homework assignments and their projects. The students also write programs to implement simple concepts in mechanical systems analysis/design and the numerical/computational techniques.

Projects: Students work on several computer-oriented projects on analysis and design multibody mechanical systems. These include mechanisms, robot manipulators, inverse dynamics problems, biomechanics, and vehicle modeling and simulation, aircraft and aerospace applications.

Engineering Design: Students are continuously instructed throughout the course to use their creativity in the analysis and design of different mechanical systems. Open-ended problems are given to the students in small projects, large projects, and many of their homework assignments.

Written and Oral Communication Skills: Students are required to submit complete reports for their projects in a required typewritten formal format. They work in teams on their kinematics and dynamics projects. Students also give oral presentations of their projects in front of the class.

**ABET category content** as estimated by faculty member who prepared this course description:
- Engineering science: 2 credits (67%)
- Engineering design: 1 credit (33%)

Relation to Program outcomes:
Knowledge of kinematics and dynamics and their application in mechanical systems analysis and design are essential for engineers working in this field. (Criterion 3 (c)) Potential Employers and graduate program expect the students to have the ability to:
- Identify, formulate and solve motion system problems in engineering. (Criterion 3 (a, e))
- Utilize these skills in multibody mechanical systems analysis and design. (Criterion 3 (b))
- Communicate effectively. (Criterion 3 (e))
- Use techniques and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: H. Lankarani, Professor Date: 1/30/06
ME 737 - Robotics and Control

2006-2008 Catalog Data:
ME 737. Robotics and Control. Credits (3 Credits). A systems engineering approach to robotic science and technology. Fundamentals of manipulators, sensors, actuators, end effectors and product design for automation. Includes kinematics, trajectory planning, control, programming of manipulators and simulation, along with introduction to artificial intelligence and computer vision. Prerequisite: ME 659 or equivalent.


Coordinator: Behnam Bahr, Associate Professor of Mechanical Engineering

Course Objective: This course familiarizes students with the fundamentals of robotic design and control of manipulators. The students are expected to use the following and learn the following:

- Apply mathematical concepts and specially linear algebra for solving the kinematics and dynamic equations.
- Learn to work in a group for their projects.
- Learn how to design, analyze, and control a robot.
- Learn basics of artificial intelligence and computer vision and write computer programs

Prerequisites by Topic:
1. Linear Algebra
2. Dynamics and Modeling
3. Classical Control

Topics: (1 class period is 75 minutes)
1. Introduction to robotics. (1 period)
2. Object manipulation through space. (3 periods)
3. Joint geometry and notations. (2 periods)
4. Kinematic and inverse kinematics equations and solutions. (4 periods)
5. Trajectory generation. (2 periods)
6. Cartesian and joint interpolation. (2 periods)
7. Dynamic analysis. (4 periods)
8. Force analysis. (2 periods)
9. Design of a controllers for robot. (3 periods)
10. Introduction to artificial intelligence. (1 period)
11. Computer vision. (3 periods)
12. Student projects related robotics and control. (1 period)
13. Tests. (2 periods)
Engineering Design: The design portion of this course is mostly done in the student project. Students are asked to design and build some innovative devices dealing with robotics. In addition, various designs for a controller are taught and reviewed. The project starts after the first month of class. The projects could be a team or individual, but we encourage students to work in team.

Computer Usage: There are several computer assignments throughout the course.

Written Communication Skills: The students are required to write a final report on their project.

Ethical, Social, Economic, and Safety Considerations: The first week of the laboratory is devoted to discussion of the safety issues. In addition, it is emphasized that the robot is designed to be operated for places where it is not suitable for human.

Estimated ABET Category Content:
Engineering Science: 2 credits or 67%
Engineering Design: 1 credit or 33%

Relation to the Program outcome:

Knowledge of manipulators, sensors and actuators in the field of robotics engineering are essential for engineers working in this field. Potential employers and graduate program expect the students to have the ability to identify, formulate and solve motion system problems in engineering. (Criterion 3 (a, e)) Communicate effectively. (Criterion 3 (g)) Use techniques and modern engineering tools necessary for engineering practice. (Criterion 3 (k)) Utilize these skills in controls and programming of manipulators and design. (Criterion 3 (b))

Prepared by: B. Bahr, Professor Date: 1/30/07
ME 747 - Microcomputer Based Mechanical Engineering Systems

2006-2008 Catalog Data: ME 747-Microcomputer Based Mechanical Engineering Systems. (3 Credits). 2R; 3L. Microcomputer-based real-time control of mechanical systems. Familiarizes students with design and methodology of software for real-time control. Includes an introduction to the C programming language which is most relevant to interfacing and implementation of control theory in computer-based systems. Laboratory sessions involve interfacing microcomputers to mechanical systems and software development for control methods such as PID. Prerequisite: ME 402 or departmental consent. Prerequisites by Topic:
1. Computer programming language
2. Classical Controls (ME 659)


Course Objective: The objective of this course is to familiarize students with the application of microcomputers in automation and control of machinery.

Topics: (1 class period is 50 minutes)
1. Boolean Algebra. (1 period)
2. Numbering system. (1 period)
3. C Language. (8 periods)
4. Data Sampling, A/D - D/A, Aliasing. (3 periods)
5. Operational Amplifiers. (1 period)
6. Electrical Motors: DC Motors, Stepper Motors. (1 period)
7. Communication & Networks. (2 periods)
8. Sensors for Control. (1 period)
9. Data Treatment. (1 period)
10. Filtering, Low pass, High pass, and Band pass. (1 period)
11. System Modeling. (1 period)
12. Continuous & Discrete Systems. (1 period)
13. Controller Design: Proportional plus Derivative plus Integral. (2 periods)
14. Programmable Logic Controller. (1 period)
15. Introduction to Micro controllers. (1 period)
16. Tests. (1 period)

Computer Usage: Students are given all of the assignments as computer programs that must be written in the C language. This is a very intensive computer use class in applications to measurement and control of mechanical systems.
**Laboratory Projects:**
1. Use of electronic equipment for measurement and testing - Digital oscilloscope, voltmeter, function generator, power supply.
3. Design and testing of the behavior of low, high, and band pass filters.
4. Use digital I/O interfaces.
5. Use and application of analog to digital and digital to analog systems through the use of C programming.
7. Controller design.
8. Students' experimental design projects with micro-controllers.

**Engineering Design:** In addition to the laboratory experiments that show students how to interface computer into their designs, the students will have to form team and work on their design project. Each term the projects vary and creativity is encouraged. The students' project will be displayed at the engineering open house for public and engineering professionals to judge. We use the input form the engineering organizations to grade each team as well as the instructor consideration.

**Written and Oral Communication Skills:** In addition to the short lab reports, a final report is required from each team about their semester projects. The oral presentations are evaluated in the engineering open house.

Ethical, Social, Economic, and Safety Considerations: The first week of the laboratory is devoted to discussion of the safety issues especially related to the laboratory projects. In addition, it is emphasized that since they will be interconnecting computers and various sensors and actuators, that safe operation of the system is an important part of the design problem.

**ABET Category Content:**
- Engineering Science: 2 credits or 67%
- Engineering Design: 1 credit or 33%

Relation to the Program outcomes:
Knowledge of design and methodology of software for real time control are essential for engineers working in this field. (Criterion 3 (c))
Potential employers and graduate program expect the students to have the ability to identify, formulate and solve motion system problems in engineering. (Criterion 3 (a, e))
Communicate effectively. (Criterion 3 (e))
Use techniques and modern engineering tools necessary for engineering practice. (Criterion 3 (k))
Utilize these skills in controls, programming and design. (Criterion 3 (b))
Prepared by: B. Bahr, Professor  Date: 1/30/07
ME 760 – Fracture Mechanics
Spring Semester, 2007

2006-2008 Catalog Data:
ME 760. Fatigue and Fracture. (3 Credits). This course discusses microscopic and macroscopic aspects of fracture mechanics under various loadings and or environmental conditions. Prerequisites: ME 250 or departmental consent.

Textbooks:

References:

Coordinator: Ramazan Asmatulu, Assistant Professor of Mechanical Engineering.

Course Objectives: This course discusses microscopic and macroscopic aspects of fracture mechanics. The objective of this course is to make students knowledgeable about the fracture mechanics and damage tolerance approach of design that describes the relationship between material toughness, design stress and allowable flaw size. The application of this approach in the analysis of certain mechanical responses of solids will be illustrated with the hope that students can explain a particular set of data or give reasoning for a service failure. Students were expected to gain or show that they possessed
A basic understanding of material toughness, design stress and allowable flaw size.
An ability to apply the knowledge of mathematics, science and engineering.
An ability to solve engineering problems.
An ability to analyze and prevent service failure.
An ability to communicate effectively and work in a group.
An ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Prerequisites by Topic:
ME 250 Materials Engineering.

Topics (1 class = 75 minutes):
Linear Elastic Fracture Mechanics (4 periods)
Stress concentration effect of flaws. Energy release rate. Stress intensity factor
Fracture mechanism in Metals. (3 periods)
Ductile, cleavage and intergranular fracture.
Fracture Mechanism in Nonmetals. (3 periods)
Engineering plastics. Ceramics and ceramic composites.
Fracture Toughness Testing of Metals. (3 periods)
KIC testing. K-R curve testing. J testing of metals. CTOD testing. Dynamic and crack arrest
toughness.
Fracture Toughness Testing of Nonmetals (3 periods)
Fracture toughness testing in plastics, composites and ceramics.
Fatigue Crack Propagation (5 periods)
Application to Structures (2 periods)
Pressure vessels. Cracks emanating from a hole. Mixed mode loading
Environmental Effects on Fracture mechanics of materials (3 periods)
Corrosion and degradation processes
Project Presentation. (2 periods)
Material properties – engineering design parameters. Selection of structural materials.
11. Examinations. (3 periods)

Written and Oral Communications Skills:
Written reports are required from each student describing the results of their fatigue and fracture project. Teams are used on projects. Presentation of projects in class is required.

Computer Usage:
None specifically assigned. Students are encouraged to use the necessary software to search for materials for their project. Also, the project is required to be prepared using a computer.

Project:
Two students in each group work on a project on case studies of fatigue or fracture.

Estimated ABET Category Content:
Engineering Science: 3 credits or 100 %

Relation to program outcomes:
1. A basic understanding of material toughness, design stress and allowable flaw size is an essential requirement for design engineers. (Criterion 3 (c))
2. Potential employers and graduate programs expect the students to have ability to:
   Apply knowledge of mathematics, science and engineering. (Criterion 3 (a))
   Identify, formulate, and solve engineering problems. (Criterion 3 (e))
   Communicate effectively. (Criterion 3 (g))
   Use techniques, skills, and modern engineering tools necessary for engineering practice. (Criterion 3 (k))

Prepared by: Ramazan Asmatulu, Assistant Professor, Date: 03/25/07
ME 762 Polymeric Composite Materials

Catalog Description:
Elective Course. 3 Credits. A basic understanding and knowledge about the structure and mechanical properties of polymeric composite materials in detail. Discusses both short fiber and continuum fiber composites. Emphasizes special design considerations for composite materials, including fracture mechanics and performance of composites under adverse conditions (fatigue and impact). Prerequisites: ME 250 and MATH 555, each with a grade of C or better, or equivalent, or instructor’s consent.

Textbook:

Course Objective:
To provide students with an understanding of polymeric composite materials.

Instructor:
Dr. Bob Minaie
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Office Hours: TR 3-4 p.m. or by appointment

Topics (1 class = 75 min.):
Materials (8 class)
Manufacturing Processes (9 class)
Mechanics (6 class)
Process Modeling (3 class)
Nanocomposites (3 class)
Examinations (2 class)

Grading: Assignments (20%), Project (40%), Exam (40%)

Grade: A>90%, B>80%, C>70%, D>60%

Policies:
Assignments will be announced in class and they are due at the beginning of the class period on the due day. Late assignments will not be accepted.
Dates for the exams will be announced in class. Make-up exams will not be given. If a student misses an exam, the student will receive a zero score for the exam.
Class attendance is necessary for satisfactory performance. It is the student’s responsibility to find out about all the assignments and announcements made in class and/or posted on the Blackboard.
Cheating and plagiarism are serious academic offenses that will result in a grade of zero for the entire assignment and/or exam that may result in a grade of “F” for the course, suspension, and/or dismissal from the University.
Course Outcomes and Relation with Program Outcomes:
The course addresses the following program outcomes:
an ability to apply knowledge of mathematics, science, and engineering
an ability to design a system, component or process to meet desired needs
an ability to identify, formulate, and solve engineering problems
an understanding of professional and ethical responsibility
an ability to communicate effectively
a recognition of the need for, and an ability to engage in life-long learning
a knowledge of contemporary issues
an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Estimated ABET Category Content:
Engineering Science: 3 credits or 100%
Engineering Design: 0 credit or 0%

Prepared by: Bob Minaie 01/16/2007