Introduction

The purpose of this new student guide is to provide you with information that will help you make decisions and get the most out of your BYU education. Underpinning this guide and at the foundation of our philosophy of education in the department is this principle: “You are responsible for your education.” Although we obviously have a large influence on the quality of your educational experience, you are ultimately responsible for how much you learn. We encourage and expect you to do more than “play the game” of getting grades. We want you to learn. If you wish to be a successful engineer you will need to learn for the rest of your life.

There are numerous opportunities to learn for which you will not receive a grade (although we would encourage you to document these activities in an optional portfolio). For example, we have a very fine student shop. A mechanical engineer should have experience in basic fabrication process. We do not have time in the curriculum to teach you how to use the machines in the shop, so we provide short courses you can take on your own to learn. When things get busy, we open the shop on Saturdays. You should also consider getting involved in one of the student clubs or societies as an important enhancement to your classroom learning.

Everything in this guide is important. Please read it carefully and hang onto it. We will provide updates from time to time as necessary. We are glad you are interested in mechanical engineering. It is a great profession and we look forward to helping you obtain a world-class education.
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Mechanical Engineering: An Overview
What is Mechanical Engineering?
Engineering is the applied arm of science and therefore requires an understanding of traditional science and math, as well as an understanding of techniques and application in real world systems and devices. The mechanical engineer applies this understanding to synthesize new products that benefit humanity. In other words, engineers use math and science to come up with creative solutions to problems.

Mechanical engineering is built upon three main areas of study: thermal and fluid science, mechanical systems, and design and manufacturing.

Thermal and fluid science includes the study of thermodynamics, fluids, and heat transfer. Some examples of thermal applications are:

- Design of a rocket engine
- Prediction of lift for an airplane wing
- Study of waves

Mechanical systems include the study of materials, dynamics, vibrations, and controls. Some examples of mechanical systems applications are:

- Building a robot
- Developing a control system for a satellite

Design and manufacturing includes computer-aided design, design, and manufacturing. Some examples of design and manufacturing applications are:

- Designing new hybrid vehicle drive trains
- Designing and testing prosthetics
What do Mechanical Engineers do?
There are many different career paths for individuals with a Mechanical Engineering degree.

- Transportation
- Manufacturing
- Communication
- Power Generation
- Agriculture
- Computer-aided Engineering
- Aerospace
- Materials
- Biomedical Engineering
- Research
- Design
- Analysis
- Testing
- Operations (not necessarily the medical kind)
- Technical Sales
- Management
- Business
- Law (with more schooling, of course)

A traditional engineering career can be characterized as having three phases: entry level engineer, established engineer and leading engineer. Not all engineers become CEOs of companies, but all engineers have the opportunity to be agents of change for society. Leading engineers benefit mankind through the application of their expertise or the management of others. Established engineers are the “back-bone” of the engineering industry. They participate in product development and research programs that give them experience and allow them to mature into leading roles. The career of an entry level engineer usually begins under the direction of other engineers as he or she participates in product development and research programs. The undergraduate university experience prepares you for a successful engineering career. However, advancement from one level to another depends on your own work, study, and commitment.
Where do Mechanical Engineers work?


Of the 93 bachelor’s degree graduates in April 2013, 42 were starting jobs with an average salary of about $61,800, and 42 students were accepted to graduate schools. The highest salary of the April 2013 graduates was $80,000, and the lowest was $43,000.

What classes will I take?

As a mechanical engineering student, you will take courses in each of the main technical areas that characterize mechanical engineering (thermal and fluid science, mechanical systems, and design and manufacturing). These courses are shown on the Flow Chart, which is available further along in this guide as well as on the ME website. You will learn fundamental phenomena associated with each area and the physical laws or principles which govern those phenomena. You will learn how to use these laws to model and predict behavior, often using the computer as a tool. Other skills are also important. An engineer must know, for example, how to communicate effectively, how to work well with others, how to learn new things, and how to define and solve problems. Thus the technical areas are only part of your education (although a very important part) that must be complimented by other skills. These other skills will also be taught as you learn the technical material.
What are the educational objectives?

The Mechanical Engineering Department at Brigham Young University pursues the following educational objectives:

- Teach the fundamental concepts of math, science, and mechanical engineering to produce graduates who demonstrate technical excellence and provide service to their profession, community, family, and church.
- Instill a desire and ability to learn continuously, both through study and faith, to enable graduates to meet the changing demands of their profession and personal life.
- Provide practical and open-ended engineering experiences to develop graduates who think independently and demonstrate leadership and creativity.
- Engage students in activities to produce graduates who communicate and work effectively and ethically with people of diverse backgrounds.

The department fully supports the Aims of a BYU Education and is committed to the idea of integrating spiritual and secular learning.

To assure that the educational objectives are reached, the department has articulated twelve outcomes of the BS program. Each student graduating from this program is expected to have the following skills, abilities, and traits:

1. A basic understanding of fundamental physical phenomena and governing principles.

2. The ability to develop and solve mathematical models of fundamental physical phenomena and apply them to predict the behavior of engineering systems.

3. The ability to use engineering principles to design an innovative system, component, or process to
meet desired needs.

4. The expertise to plan and conduct an experimental program and evaluate the results.

5. The ability to use modern engineering tools and techniques in engineering practice.

6. An understanding of manufacturing processes and planning.

7. Effective oral and written communication skills.

8. The ability to work with and lead others to accomplish common goals.

9. An appreciation of history, philosophy, literature, science, and the fine arts and how they influence the culture and behavior of societies.

10. Personal behavior demonstrating and practicing high moral and ethical standards.

11. The ability to practice engineering in a global environment.

12. A desire for and commitment to lifelong learning and service.

All courses in the curriculum are designed to help achieve these outcomes. For further information regarding individual course outcomes, please see the University’s Undergraduate Catalog.
You are in control of your education. Take the wheel and steer!

The introduction to this guide discusses our desire for you to take responsibility for your education. How do you do this? The best way is for you to take responsibility for your learning. In each course you take, you should strive to learn what is being taught, whether or not you see the relevance. Be an active participant, seeking to take advantage of all learning opportunities, both in and out of the classroom. In addition, you must become familiar with the department program, procedures, and course requirements. Learning and knowing this information is your responsibility.

We suggest the following ideas:

**Freshman year:**
- Take the prerequisite courses and get good grades.
- Apply to the program (even if you are going on a mission—your spot will be held). Fill out the application and turn it in to the mechanical engineering department.
- Meet with the Undergraduate Advisor to plan your graduation path, ask questions, and learn about the mechanical engineering program outcomes (this is required as part of ME EN 191).

**Sophomore year:**
- Start a portfolio. Keep your best work from your ME classes. Include reflections on your learning activities.
• Find and meet your assigned faculty advisor (assignments occur after admittance).
• Start thinking about internships or doing research in a professor’s lab (meaning that you need to be proactive and learn what is available and what the professors do).
• Join a club or start volunteering in a lab (again, be proactive).

Junior year:
• Meet with your faculty advisor to plan your technical electives, discuss graduate school or career options, and show your portfolio.
• Continue taking courses that will keep you on track for your planned graduation.
• Add more items to your portfolio (engineering week work, design/lab projects or write-ups from junior courses).
• If you have had an internship or other professional experience, include this in your portfolio.
• Apply for Capstone (usually this will happen in late March or early April. Watch around the department for advertisements).

Senior year:
• Do a final graduation check with the Undergraduate Advisor.
• Apply for graduation (this is done online).
• Complete your Shop Clearance Form, Graduation Survey, and Exit Interview (these are NOT optional).
• Finish Capstone.
Frequently Asked Questions
How do I get into the major?
BYU’s Mechanical Engineering major is a Limited Enrollment Program, which means we only admit a certain number of students per year. In order to be admitted to our program, you must complete the required “Application Courses,” and then fill out and submit the application. We admit based on the GPA average of the Application Courses. Typically, students with a 3.4 average or higher will get into the major.

The Application Courses are ME EN 172, CE EN 103, PHSCS 123, and the first math class (Math 112 or higher) that you take at BYU. You must also take and pass ME EN 191 before you can apply. Transfer students have special circumstances, and should consult the Undergraduate Advisor for assistance.

There is a page on the ME website (me.byu.edu/content/applying-professional-program) with a significant amount of information about the application process, including historical averages of applications, admits, and GPAs.

What if my grades aren’t high enough?
Remember, we are looking at the Application Courses for the GPA, so don’t panic if you get a B- in American Heritage! If you are unhappy about the grades you get in the Application Courses, you may take each of those courses again one time, and we will use the highest grade for your application.

How many times can I apply?
You may apply as many times as you desire. However, once you have taken all the Application Courses twice, if you still do not make the GPA cutoff, you will not be able to get into the program.
Do I have to take ME EN 191?
Yes. You have to pass it before you can apply to the program.

What classes do I take each semester?
We have provided a flowchart to help you navigate your way through the program. You are not required to follow it exactly, but in order to graduate in a timely manner you should try to follow it as closely as possible, paying close attention to prerequisite requirements. (See flowchart on adjacent page)

What is Capstone?
Capstone is our two-semester senior design project course (ME EN 475 and ME EN 476). All Mechanical Engineering students are required to take it. It is intended to be the culminating project of your undergraduate experience, and you will take it during your final year in the program. Please see the Capstone website (capstone.byu.edu) for more information.

What Technical Electives can I take?
The Technical Electives are meant to allow you freedom to pursue courses that will give you a “specialty” in your particular areas of interest. The department has provided a list of approved Technical Electives. If a course is not on the list, you may NOT count it as a Technical Elective. You can find the current list of approved Technical Electives on the ME website at me.byu.edu/content/technical-elective-requirements
### MECHANICAL ENGINEERING DEPARTMENT - BS Degree Program

**SUGGESTED GRADUATION PLAN - 2013-2014**

*Note: The ABC printout shows official requirements for each student*

#### COURSE KEY

<table>
<thead>
<tr>
<th>Number</th>
<th>Hrs</th>
<th>Course Title</th>
<th>Prerequisites</th>
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<td>Univ. Core</td>
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<td>Pre-Prof.</td>
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<td>Prof.</td>
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#### UNIVERSITY CORE

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<tr>
<th>SEMESTER</th>
<th>COURSE</th>
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<tbody>
<tr>
<td>SEMESTER 1</td>
<td>Rel A 121: Book of Mormon 1</td>
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<tr>
<td>SEMESTER 2</td>
<td>Rel A 122: Book of Mormon 2</td>
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<tr>
<td>SEMESTER 3</td>
<td>Rel A 211 or 212 N Testament</td>
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<td>SEMESTER 4</td>
<td>Rel C: 324 or 325 Doct &amp; Cov</td>
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#### MAJOR REQUIREMENTS

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<thead>
<tr>
<th>SEMESTER 1</th>
<th>CEEEn 103: New Student Seminar</th>
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<tbody>
<tr>
<td>SEMESTER 2</td>
<td>CEEEn 104: Mechanics</td>
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<td>SEMESTER 5</td>
<td>CEEEn 204: Dynamics</td>
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</tbody>
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#### NOTES

* p or c means prerequisites or concurrent enroll is required

* course also fulfills GE requirements

#### Technical Elective Courses

5 courses (15 hrs) required

1. At least 3 in ME
2. None below 300-level
3. Courses must be of acceptable level from MeEn, CEEEn, CTEn, ECEEn, Math, Stat, Phscs, Chem, or approved list on the ME website
4. No duplicates of required courses
5. 3 credit-hr max in ME 497R or other project classes

#### Capstone requirements

1. MeEn 363, MeEn 372, MeEn 373
2. No more than 30 hours left in the program
3. Must be taken consecutive Fall/Winter semesters

### Frequently Asked Questions

**15.** Applying to the Program

1. Complete the following:
   a. one math (112, 113, 302, 303) or (112, 113, 313, 314, 334)
   b. Phscs 123 or Phscs 220
   c. CE En 103
   d. Me En 172
   e. Me En 191
2. Apply at the ME department office
3. No MeEn Courses 200-level or above may be taken until accepted into professional program

**16.** Technical Elective Courses

5 courses (15 hrs) required

1. At least 3 in ME
2. None below 300-level
3. Courses must be of acceptable level from MeEn, CEEEn, CTEn, ECEEn, Math, Stat, Phscs, Chem, or approved list on the ME website
4. No duplicates of required courses
5. 3 credit-hr max in ME 497R or other project classes

**17.** Capstone requirements

1. MeEn 363, MeEn 372, MeEn 373
2. No more than 30 hours left in the program
3. Must be taken consecutive Fall/Winter semesters
Can I get an emphasis?

We offer a manufacturing emphasis. If you are interested in pursuing this emphasis, you may consult the University’s Undergraduate Catalog to see which courses you should take. If you are interested in pursuing a different area of focus, choose your Technical Electives to steer you in that direction.

For example, if you are interested in Aerospace, you could take ME EN 523 (Design of Aircraft Structures), ME EN 426 (Gas Turbine and Jet Engine Design) and ME EN 415 (Applied Aerodynamics and Flight Mechanics). The other technical electives that you choose are up to you, but these classes would give you a foundation for the material pertaining to Aerospace.

Where can I go if I have questions or if I need help?

Parents, siblings, and roommates are excellent sources of advice and wisdom, but if you have questions about the department or the program, please come to us.

- We have a caring and knowledgeable Undergraduate Advisor who is always willing to help. You can make an appointment by calling the main Mechanical Engineering office at 801-422-2625.
- We have an excellent Advisement Center in the College. You can make an appointment there by calling 801-422-4325, or by stopping in 242 CB.
- We have a well-maintained website. Please visit us there at me.byu.edu
- Don’t hesitate to make an appointment with your faculty advisor, or a professor from one of your classes, or a faculty member you have identified as one with whom you might like to work. We have a fantastic faculty who care very much about your success. You can get contact information for any of our faculty or staff from our website.
<table>
<thead>
<tr>
<th>Technical Area of Emphasis</th>
<th>Technical Elective Courses</th>
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<tbody>
<tr>
<td>Acoustics</td>
<td>MeEn 535 Mechanical Vibrations&lt;br&gt;MeEn 561 Fundamentals of Acoustics&lt;br&gt;MeEn 562 Analysis of Acoustic Systems</td>
</tr>
<tr>
<td>Aerospace</td>
<td>MeEn 415 Applied Aerodynamics and Flight Mechanics&lt;br&gt;MeEn 425</td>
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<tr>
<td>Automotive</td>
<td>MeEn 425 Internal Combustion Engines&lt;br&gt;MeEn 477 Design for Manufacture and Assembly&lt;br&gt;MeEn 501 Stress Analysis and Design of Mechanic Structures</td>
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<td>Biomechanics</td>
<td>MeEn 555 Introduction to Biomechanics&lt;br&gt;ChEn 518 Biomedical Engineering Principles&lt;br&gt;PDBio 305 Human Physiology and Lab&lt;br&gt;Chem 351 Organic Chemistry&lt;br&gt;Chem 481 Biochemistry</td>
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<tr>
<td>Computer-Aided Engineering</td>
<td>MeEn 471 CAE Applications&lt;br&gt;MeEn 570 CAE Software Engineering&lt;br&gt;MeEn 578 CAD/CAM Applications</td>
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<tr>
<td>Design/Manufacturing</td>
<td>MeEn 477 Design for Manufacture and Assembly&lt;br&gt;MeEn 482 Manufacturing Systems Analysis and Design&lt;br&gt;MeEn 486 Automation&lt;br&gt;MeEn 550 Microelectromechanical Systems (MEMS)&lt;br&gt;MeEn 575 Optimization Techniques in Engineering&lt;br&gt;MeEn 576 Product Design&lt;br&gt;MeEn 578 CAD/CAM Applications&lt;br&gt;MeEn 579 Global Product Development&lt;br&gt;MeEn 584 Manufacturing Process Machine Design&lt;br&gt;MeEn 585 Manufacturing Competitiveness: Quality and Product</td>
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<tr>
<td>Dynamics and Vibration (Mechanics)</td>
<td>MeEn 415 Applied Aerodynamics and Flight Mechanics&lt;br&gt;MeEn 437 Kinematics&lt;br&gt;MeEn 508 Structural Vibrations&lt;br&gt;MeEn 534 Dynamics of Mechanical Systems&lt;br&gt;MeEn 535 Mechanical Vibrations&lt;br&gt;MeEn 537 Advanced Mechanisms: Robotics</td>
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<td>Subject</td>
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<tr>
<td>Fluid Mechanics</td>
<td>MeEn 412 Applications to Fluid Dynamics</td>
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<td>MeEn 510 Compressible Fluid Flow</td>
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<td>MeEn 512 Intermediate Fluid Mechanics</td>
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<td>Heat Transfer</td>
<td>MeEn 540 Intermediate Heat Transfer</td>
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<td>MeEn 541 Computational Fluid Dynamics and Heat Transfer</td>
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<td>Instrumentation and Controls</td>
<td>MeEn 431 Design of Control Systems</td>
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<td>MeEn 564 Digital Instrumentation and Mechatronic Systems</td>
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<td>MeEn 570 Computer-Aided Engineering Software Development</td>
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<td>Materials</td>
<td>MeEn 500 Design and Materials Applications</td>
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<td>MeEn 452 Intermediate Materials</td>
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<td>MeEn 456 Composite Materials Design</td>
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<td>MeEn 558 Metallurgy</td>
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<tr>
<td>Mechanisms, Robotics</td>
<td>MeEn 437 Kinematics</td>
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<td>MeEn 472 Mechanical Systems Design Applications</td>
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<td>MeEn 537 Advanced Mechanisms, Robotics</td>
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<td>MeEn 538 Compliant Mechanisms</td>
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<td>MeEn 570 CAE Software Engineering</td>
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<tr>
<td>Stress Analysis &amp; Structures</td>
<td>MeEn 501 Stress Analysis and Design of Mechanical Structures</td>
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<td>MeEn 503 Plasticity and Fracture</td>
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<td>MeEn 504 Computer Structural Analysis and Optimization</td>
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<td>MeEn 506 Continuum Mechanics and Finite Element Analysis</td>
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<td>MeEn 523 Aircraft Structures</td>
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<td>Thermodynamics</td>
<td>MeEn 422 Applied Thermodynamics</td>
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<td>MeEn 425 Internal Combustion Engines</td>
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<td>MeEn 426 Gas Turbine and Jet engine Design</td>
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<td>MeEn 521 Intermediate Thermodynamics</td>
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<td>MeEn 522 Combustion</td>
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Student Opportunities
Student Clubs and Societies
BYU, the College, and the Department provide many interesting and exciting programs. These programs provide valuable opportunities for learning and growth, and will help you learn leadership skills, gain technical experience, and distinguish yourself as an emerging professional.

Department Sponsored Student Chapters of Professional Societies

1. American Society of Mechanical Engineers (ASME)—promotes the art, science and practice of multidisciplinary engineering and allied sciences around the globe.

2. American Institute of Aeronautics and Astronautics (AIAA)—the heart of aerospace. With more than 31,000 members, AIAA is the world’s largest professional society devoted to the progress of engineering and science in aviation, space, and defense.

3. Society of Automotive Engineers (SAE)—a global association of more than 128,000 engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries. SAE International’s core competencies are life-long learning and voluntary consensus standards development.

4. Society for the Advancement of Materials and Process Engineering (SAMPE)—an international professional member society that provides information on new materials and processing technologies through chapter technical presentations, two journal publications, symposia and commercial expositions in which professionals can exchange ideas and air their views. As the only technical society encompassing all fields of endeavor in materials and processes, SAMPE provides a unique and valuable forum for scientists, engineers, designers and academicians.
Fulton College of Engineering and Technology Sponsored Societies

1. Tau Beta Pi (Engineering Honor Society)—founded in 1885 to mark in a fitting manner those who have conferred honor upon their alma mater by distinguished scholarship and exemplary character as undergraduates in the field of engineering, or by their attainments as alumni in the field of engineering, and to foster a spirit of liberal culture in the engineering colleges.

2. Society of Women Engineers (SWE)—a national educational and service organization founded in 1950. SWE is the driving force that establishes engineering as a highly desirable career aspiration for women. SWE empowers women to succeed and advance in those aspirations and be recognized for their life-changing contributions and achievements as engineers and leaders.

3. Global Engineering Outreach (GEO)—this group works to solve global needs by creating community-driven development through the design and implementation of sustainable engineering projects. They work to train and involve internationally responsible engineering students.

If you are interested in getting involved in any these groups, you can find more information on the ME website. BYU also maintains an excellent website for campus clubs at clubs.byu.edu/home
Summer Internships

Another important opportunity is an internship. The Mechanical Engineering Department does not require students to obtain an internship, but we strongly encourage it. You do not have to wait until you are a junior or senior—sophomores and even freshmen can get an internship.

An internship is a career-appropriate job that you take before you have finished your education. Internships are different than “co-ops.” A “co-op” is a job opportunity at an outside company that is sponsored by the University and for which you get course credit. Because of liability issues, few co-ops are available.

Advantages of an Intern Experience

Few engineering students have a clear picture of what an engineer actually does. As an intern, you get to work alongside engineers on real-world problems and gain valuable experience. Not all jobs are equally challenging, but most companies try to find an interesting project that will benefit both the intern and the company.

Companies realize that summer internships are great recruiting tools. You get a good look at the company and they get a good look at you. If you have a good experience, you are more likely to accept an offer for permanent employment after you graduate. If they like you, they are more apt to give you a good offer than someone they don’t know.

How to Obtain an Internship

1. Visit the College Advisement Center (242 CB). They have information and job listings, as well as a dedicated Career Counselor.
2. The Counseling and Career Services Center (2500 WSC) has job listings. They also have many resources to help you research companies to contact.
3. The Mechanical Engineering Department External Relations Coordinator (435 CTB) can help you identify opportunities and can also review your resume.

4. Attend the BYU Career Fair. Each Fall semester, leading companies come to our campus to advertise and recruit. This is an opportunity for you to talk to a representative in person, and many will accept resumes for internships. Come prepared.

5. Talk to people, network with friends and relatives, and find out what jobs are available. Send out resumes. Make appointments for interviews. The more effort you make, the more likely you are to get an internship.

Take practical and consistent measures to obtain an internship. We have resources to assist you in finding and preparing for opportunities, but ultimately the effort and initiative required to succeed depends on you.
Mechanical Engineering Department
ME EN 191
Advisor Interview

Name_________________________________Student ID____________________Email__________________

Bring this completed form to your advisor interview. Please read the New Student Guide before your interview. The purpose of the interview is to provide an opportunity for you to ask questions and discuss your educational plan, career goals, and other issues of concern with the undergraduate advisor.

Please tell us a little bit about yourself (where from, family, hobbies, interests, aspirations, etc.)

Why have you chosen to investigate mechanical engineering?

What classes in Mechanical Engineering sound most exciting to you?

Look over the program outcomes for Mechanical Engineering at BYU (in your New Student Guide) and tell us which outcomes best match your goals and interests.

What activities outside of classes are you interested in to help prepare you to be a mechanical engineer?

What concerns do you have about coursework and other preparation for the degree?
Using the Projects Lab
Using the Projects Lab

The Mechanical Engineering Department runs a well-equipped Projects Lab. It is located in room 150 of the Clyde Building and is supervised by an excellent machinist, Ken Forster, who is happy to help you. Once you have completed the required training, you may also use the School of Technology Manufacturing Lab located on the ground floor (Room 101) of the Crabtree Building.

As was stated in the section on program outcomes, mechanical engineers need to understand basic fabrication processes. From time to time, you will need to make devices for experiments in your courses or for projects. There is also a sense of satisfaction and confidence that comes from knowing how to make things. For these reasons, we encourage you to learn to use the Projects Lab as a freshman. The small investment in time you make now will pay big dividends throughout your college career.

Except for materials, there is usually no fee associated with using the Projects Lab. Personal learning projects are welcomed; however, they must first be approved by the shop manager. The Projects Lab is NOT a “hobby shop.”

To be able to use the Projects Lab, you must do four things:

1. Have a pair of safety glasses (available at the Bookstore).
2. Carefully read the “Projects Lab Safety Information” portion of this guide.
3. Fill out the one page safety test and bring it with you to the lab.
4. Receive instruction from Projects Lab personnel on how to perform the manufacturing operations necessary to complete your project.

The Basic Projects Lab Skills mini-course, associated with ME EN 191, consists of 3 two-hour sessions with an instructor. Each session covers different basic machining topics. These sessions are offered at the beginning of each semester.

The Projects Lab is open 8-5 Monday through Friday and occasionally on Saturdays when demand warrants it. To use the lab on Saturday, you must sign up in advance. The Projects Lab exists for your benefit. Take advantage of this tremendous resource.
Projects Lab Safety Information
This safety information is a basic introduction to operating the equipment in the Mechanical Engineering Projects Lab. It discusses some of the most commonly used machines and procedures. It is not intended to be the primary operating instructions for any machine.

Individual, personal instruction is necessary before operating any equipment or performing any machining procedures. Attempting to operate a machine by trial and error is a major safety violation and can cause severe injury to the operator and/or damage to the machine. You are responsible for your safety and the safety of those working around you. You are also responsible for preventing damage to equipment.

General Safety Rules (apply to all lab areas)

Eye protection
Safety glasses with side shields or goggles must be worn at all times while in the Projects Lab and other areas where machinery is in operation. Approved eye protection will be labeled as meeting the ANSI Z87 safety standard. Ordinary prescription glasses do not qualify as approved eye protection and must be supplemented by goggles or safety glasses designed to fit over glasses. Face shields are not approved primary eye protection and should only be worn over approved safety glasses or goggles.

It is your responsibility to provide your own eye protection. Both safety glasses and goggles are available at the bookstore and many local retailers.

Working alone
University policy, in accordance with state and federal regulations, requires that two persons be present in a lab facility when equipment is in operation. At no time are you allowed to work alone in a lab area (this means that another adult must be in the same room with you).

Machine Guards
Machine guards are to be used at all times. If there is an operation that requires the removal of a guard, you must obtain permission from the supervisor or TA assigned to that lab.

Personal Responsibility
Safety first. You are ultimately responsible for all that you do! Follow ALL safety and operation guidelines posted for each machine. Training is available for every piece of equipment available for your use. If you are unfamiliar with a machine or operation, please ask for assistance. Attempting to use machine tools without proper training may
result in serious injury and/or damage to the machine. The primary responsibility of all lab supervisors and assistants is to assist you in your education and safe use of the lab facilities. You will be held responsible for damage caused by your neglect.

**Honor Code**
The resources made available to you within the labs are some of the most costly the university maintains. You are expected to maintain the high standards outlined within the honor code as you use the facilities. Please do not expect to use the lab areas if you are in violation of the honor code.

**Clean-up Requirements**
You are responsible to clean up after working in the lab area. This includes:
- Replacing all tools used (please clean tools before putting them away)
- Cleaning up any chips or shavings produced
- Removing or storing your project components
- General cleanup of work area

If you are working on a project and need to leave for a short period of time (one hour or less), let the supervisor or TA know when you will be back to finish your work and clean up your work area.

**Project Storage**
Storage is only available for projects that are in progress and are related to your course work. You must obtain approval from the lab supervisor or TA to store projects in the Projects Lab areas. Any projects or materials that are left out in the lab will be removed or discarded. If you want to keep it, please take care of it.

**Use of Materials**
If you didn’t buy it or bring it, it isn’t yours! If you need materials, talk to the lab manager or one of his assistants. Some materials are available for purchase from the ME Projects Lab and also the Precision Machining Lab (108 CTB). Materials needed for class assignments can be obtained from the Mechanical Engineering Projects Lab at no cost, but please do not cut up something until you have obtained permission.

**Tool Checkout**
All tools are to remain in their appropriate lab areas. If you need to remove a tool from the Projects Lab, speak with the lab manager or one of his assistants. The Projects Lab is not a tool check-out facility.
Specific Safety Guidelines (General Safety)

- **Speeds and Feeds**: Choosing and setting the correct speeds and feeds is critical to many machine operations. If you do not know how to determine these parameters, ask for assistance.

- **Unusual Noises**: If you hear something unusual or suspect something has changed, stop what you are doing and check it out. Pay close attention to what you are doing at all times.

- **Machine Operation**: Never leave a machine running unattended. CNC machines designed to run unattended may be left unattended only after the program has been adequately proven to be accurate and problem free.

- **Clothing**: Long sleeves, loose clothes, neck ties, jewelry, long hair, etc. can be hazardous in many shop situations. Before operating any equipment, thoughtfully consider these potential hazards.

- **Lifting Heavy Objects**: Get assistance. When lifting, keep your back as straight as possible and lift with your arm and leg muscles.

- **Moving Large or Awkward Materials**: Ask for assistance from others. Clear a path to where the material is to be moved and warn others working near the path before moving materials.

- **Broken or Damaged Tools**: Immediately report broken or damaged equipment or tools to the lab supervisor or TA. It is expected that tools will become dull occasionally and equipment will suffer from wear and tear. It is important that these items be brought to our attention so that the equipment and tools can be maintained and operated safely.

- **Machine Operation**: Only one person is to operate a machine at one time. It is extremely hazardous for more than one person to work the controls of a machine. If assistance is needed to support materials being processed, the assistant should only provide support and allow the operator to provide all motion to the work piece or machine.

- **Horseplay**: Horseplay of any kind can be extremely hazardous in a lab area and is forbidden at all times.

- **Correct Tools**: Always use the correct tool for the job. If you are not sure what is needed, please ask for assistance.

- **Sharp Tools**: Sharp tools are safer, provide better results, and require less effort to accomplish a task. If you suspect that a tool is dull, ask for assistance to have it sharpened or replaced.

- **Safety Equipment**: Know the location of safety equipment. Fire extinguishers, eye-wash stations, emergency showers, telephones, etc. are only useful if you know where they are.

- **Emergency Situations**: Call 911 if there is any question about the seriousness of an emergency. Your first responsibility is to get as much assistance as possible to the situation while providing emergency care to the best of your knowledge.

- **Fire Alarms**: If the fire alarm sounds, immediately turn off all equipment you are oper-
ating and exit the building. Follow the guidelines of the lab supervisor or TA in exiting the building.

- **First Aid**: Immediately report all accidents to a lab supervisor, TA, or faculty member. Minor first aid is available for simple cuts or abrasions. BYU is not responsible to pay for medical services required for accidents within its lab areas unless specific liability is established. You should make medical care decisions based upon the assumption that you will be responsible for payment.

- **Material Spills**: If you spill liquids or materials on the floor, immediately clean up. If the materials are hazardous in nature, immediately notify the supervisor or TA to determine what course of action should be taken.

- **Chemical Management**: You should always wear splash-proof goggles and appropriate protective clothing when handling hazardous chemicals.

- **Hazardous Materials**: You must notify the lab supervisor or TA of your intent to bring hazardous materials into a lab area before doing so.

- **Disposing of Chemicals**: Never put anything but water down the drain! BYU has a chemical management department that will assist with the disposal of chemicals.

- **Chemical Amounts**: You should only acquire the amount of chemicals required for your work. Disposing of chemicals is often a greater expense than their initial purchase.

- **Mixing Chemicals**: Never mix chemicals of unknown origin or if you are in doubt about the outcome. Many chemicals are incompatible and become volatile or toxic when mixed improperly. If you are in doubt, get assistance.

- **Chemical Storage**: Improper chemical storage is a major hazard throughout the College and University. Chemicals must always be stored in their original container. Never put chemicals of any kind in an unmarked container. Please discuss your chemical storage needs with the lab supervisors. When you are done with your project work, make sure that all chemical materials are properly taken care of.

**Welding Area**

- **Safety Glasses**: Welding helmets do not satisfy the requirement for primary eye protection. Safety glasses must be worn under arc welding helmets to fulfill the eye protection requirement.

- **Hot Materials**: Never touch materials to see if they are hot. Place your bare hand above the material and feel for radiated heat to determine its temperature. Never pick up hot materials with welding gloves. Although this may not result in a burn to your hand, it will cause the glove leather to shrink and become hard. Never leave a piece of hot material unattended without labeling it “hot.” Soapstone marks hot material well.

- **Acetylene Regulators**: Always set acetylene regulators to less than 15 psi. Above 15 psi, acetylene becomes explosively unstable. Always back the acetylene regulator pressure completely off before installing a new gas bottle. The acetylene valve on the bottle should only be opened ¼ to ½ turn so that it can quickly be closed in an
• **High Pressure Gas Regulators**- Most bottled gasses (except acetylene) utilize high pressure regulators. These regulators should be backed off before installing them on a new gas bottle. The bottle valve has a double seat and should be opened all the way to prevent leakage around the valve stem.

• **Protective Clothing**- All forms of electric arc welding and cutting produce extremely intense ultraviolet and infrared light that can cause serious burns to unprotected skin. These intense burns are suspected as promoting skin cancer in later years. Always wear appropriate protective equipment, including welding gloves, long sleeves, long pants, etc.

• **Wire Wheels**- A face shield is required to be worn over your safety glasses when using a wire wheel.

• **Welding Hoods**- Inspect the welding hood before use to ensure that the lenses and filters are in good condition and of the proper shading for the operation being performed. Never attempt to weld without proper eye protection.

**Woodworking**

• **Blade Rotation**- Wood should always be fed into the cutter against the blade rotation. This is especially important with router bits. Always check blade rotation when performing operations that allow you to feed stock from more than one direction. Never use the rip fence on the table saw as a length stop when cross cutting wood. The cut off piece could get wedged between the saw blade and the fence and get kicked back at the operator.

• **Band Saw**- Adjust the upper blade guide to about ¼” above the surface of the material being cut. Use caution in backing out of cuts. This could pull the blade out of its guides, resulting in possible operator hazard and or blade damage. Please follow operator instructions attached to the machine.

• **Push Sticks/Blocks**- When cutting small pieces of materials, use a push stick/block instead of your fingers to move material through the cutter.

• **Table Saw**- Adjust the blade to protrude approximately 1/8” above the height of the material being cut. The exception is when cutting thin, brittle materials such as Formica or Plexiglas. These materials require that the blade protrude approximately 1” above the material. Use extreme caution when cutting these materials. Do not attempt to cut conductive materials such as carbon fiber composites with the table saw. A safety device must first be deactivated in order to cut these types of materials.

• **Sanders**- As with other power tools, always make sure that your work is securely held, and never lean into the machine as you push material into the sander/cutter. If you slip, a part of your body could be the next thing to go in to the sander/cutter. Feed your work piece carefully into the sander so as to prevent it from being pulled or twisted from your grasp. Never sand material that is thin enough to become wedged between the sanding belt/disc and the work rest.

• **Dull Tools**- If a sander or cutter is burning the surface of your wood work piece, and/
or it takes more than moderate force to get the power tool to cut, the cutting edges may be dull. Alert lab personnel when you find dull or worn cutting tools.

- **Sharp Hand Tools**: Never cut toward yourself when using sharpened hand tools. The work piece should be secured in a vise or clamp instead of being held in your hand.

**Grinding**

- **Pedestal Grinders**: The work support should be adjusted as close to the wheel as possible. A grinder should not be used that does not have a wheel guard. Never hold work to be ground using gloves. It can get caught in the wheel and pull your hand into the grinder. Small work can be held using pliers or some other clamp. Do not use the side of the wheel for grinding. Never grind thin parts that can get wedged between the work rest and the grinding wheel. Do not grind non-ferrous (aluminum, brass, zinc, copper, etc.) metals. These materials fill the pores of the grinding wheel face and destroy its ability to cut. They may be sanded on the belt or disc sander.

- **Wheel Dressing**: Grinding wheels require dressing and truing to cut properly. If the wheel does not seem to be freely removing material or the material is quickly heating up, the wheel may need to be dressed.

**Lathe Operation**

- **Mounting Chucks**: Always protect the bed of the lathe when mounting a chuck by using a board or chuck cradle set on the bed ways. Do not remove or mount chucks unless you have been instructed on how to do it properly.

- **Chip Removal**: Never remove chips with your hand. Use a brush, chip hook, or pair of pliers to remove chips.

- **Rotating Parts**: Lathe operations involve rotating chucks and work pieces. Use extreme caution to keep away from the rotating parts. Never touch the work piece or make measurements while the part is turning. Remove long, stringy chips only when the lathe is stopped. It is a good idea to turn the spindle by hand before turning the power on to ensure that there is no interference between the rotating parts and the machine. Note: if lathe chuck jaws are opened too far, they can come out of the chuck during lathe operation, causing severe damage.

- **Changing Speeds and Feeds**: Never change gears while the lathe is running. If you cannot get the machine to go into gear, rotate the spindle by hand as you operate the shift lever.

- **Chuck Wrenches**: Always remove the wrench from the chuck, even if you will be using it soon. This needs to become a habit. The chuck wrench may be in the chuck ONLY if it is also in your hand!

- **Mounting Stock in Chucks**: Stock should not protrude from the chuck or collet (unsupported by a center or steady-rest) more than three times the stock diameter. Stock should not extend out of the headstock end of the spindle more than twenty times its diameter.

- **Tool Alignment**: Proper tool alignment and height is critical for good material removal
Milling Machine Operations

- **Variable Speed Heads**: On machines equipped with variable speed heads, speed should only be changed with the spindle running.
- **Climb vs. Conventional Milling**: Because climb milling causes less wear to the milling cutter, requires less cutting force, and leaves a better surface finish, it should be used whenever possible. When a milling cutter climb cuts, it tends to pull the work into the cutter. When milling thin sections, using large cutters, or using milling machines that have excessive backlash in the feed screw, it may be necessary to use conventional milling.
- **Removing chips**: Never remove chips with your hands. Use a brush to sweep chips from the part. Caution: The chips produced by milling cutters are very hot and can be thrown some distance.
- **Measuring**: Never measure parts with the spindle turning.
- **Remove Mill Tooling**: To remove tooling from the spindle, unscrew the draw bar with the wrench while holding the spindle brake on. Loosen the draw bar until it can be turned by hand. Loosen it two full turns by hand and then tap the end of the draw bar to loosen the taper while holding the cutting tool with the other hand, as the tool may fall out of the collet as it is tapped loose. Then finish unscrewing the draw bar until the tool/collet is free. To install a collet/tool in the spindle, first clean the spindle taper and the collet/tool. Insert the collet/tool into the spindle and rotate it until the keyway on the collet/tool lines up with the key inside the spindle. Hold the collet/tool in the spindle while you reach up and screw the draw bar into it by hand. Use the wrench to tighten the draw bar securely.

General Purpose Machines

- **Drill Presses**: Unless you are using a very small drill, secure all work in a vise or clamp it to the table. We cannot have the work piece break free and begin to rotate. Let up on the pressure as you approach breaking through material that you are drilling. Never leave the chuck key in the chuck.
- **Contour Band Saw**: Be sure speed is set correctly for the type of material to be cut. Your material must be thick enough so that at least two teeth of the blade are engaged in it at all times.
- **Abrasive Cut-off Saw**: Gently start the cut and then feed with moderate to heavy pressure until the cut is finished. The idea is to keep the blade moving through the material without using excessive force that would prematurely wear away the cutting wheel. This will result in quicker cuts, less heat in the work piece, and less wheel wear. Because the cutting surface of the abrasive cut-off wheel breaks down relatively fast, it is ok to cut nonferrous materials (aluminum, brass, copper, etc.) on this saw.
Mechanical Engineering Department
Projects Lab Safety Test

Name__________________________________________

1. What is your personal responsibility regarding safety?

2. What is your personal responsibility regarding the physical facilities?

3. What is your personal responsibility to others using the Projects Lab facilities?

4. What role does training play in Projects Lab Safety?

I, __________________________(print your name), have read the Projects Lab policy and safety regulations and understand them as they apply to my work in the lab areas. I agree to abide by the published regulations and accept personal responsibility for my work in the labs and other areas. I understand that it is a privilege and learning opportunity to work in the shop/lab areas and agree to abide by all university regulations and stipulations placed upon me as conditions for working in these areas. I understand that my failure to do so can result in my loss of privileges in the shop/lab areas.

Signed______________________________________________ Date__________________________