

BYU | MECHANICAL ENGINEERING

UNDERGRADUATE GUIDE



IRA A. FULTON COLLEGE OF ENGINEERING
2022-2023

Big Inspired Goal

Be recognized as the best undergraduate mechanical engineering program in the world and the alma mater for the world's most influential engineers.

Envisioned Future

- The strength of our undergraduate program will be fueled by opportunities for learning and knowledge creation that flow out of a vibrant and vital graduate research program.
- Graduates of our program (both undergraduate and graduate) will be highly sought after by top universities, corporations, and engineering enterprises and will lead many such organizations.
- Our graduates will understand the influence of the Spirit and how it applies to their profession and the creative process.
- Faculty, staff, students, and alumni will be recognized as individuals of faith and integrity.
- Our faculty will be recognized nationally and internationally as experts in their fields.
- The technology created within our department will have significant economic and societal impacts.
- Our curriculum will be exemplary; our methods and materials will be widely respected and used by others.
- We will have external partners that readily provide resources and other support necessary to fulfill our core purpose.

Introduction

The purpose of this undergraduate 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 fine Projects Lab. A mechanical engineer should have experience in basic fabrication processes. We do not have time in the curriculum to teach you how to use the machines in the Projects Lab, so we provide opportunities for you to learn on your own. 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 refer to it often. 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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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:

- Designing a rocket engine
- Predicting lift for an airplane wing
- Modeling wave action

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
- Computer-aided Engineering
- Agriculture
- Aerospace
- Materials
- Biomedical Engineering
- Research
- Design
- Analysis
- Testing
- Operations
- Technical Sales
- Management
- Business
- Law

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 “backbone” 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?

BYU Mechanical Engineering students have been hired by such companies as Boeing, Valtek, Motorola, G.E., Intel, Ford, Micron, Westinghouse, Hewlett Packard, General Motors, Pratt & Whitney, Texas Instruments, Lockheed Aerospace, Bell Helicopter, NASA, Argonne Labs, Beech Aircraft, Fibertek, FMC Corp., EXXON, Allied Signal, Honda, Iomega, AT&T, Bechtel, Hughes, Morton International, BD Medical, US Synthetic, Goodman Manufacturing, Lockheed-Martin, Union Pacific, Toyota, Northrup Grumman, and Schlumberger.

Of the 149 bachelor's degree graduates in April 2021, 51.25% were starting full-time jobs with an average salary of \$70,738 and 40% of students were accepted to graduate schools.



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 computer programs. 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.

An engineer must know how to communicate effectively, how to work well with others, how to learn new things, and how to define and solve problems.

What are the Educational Objectives and Program Outcomes?

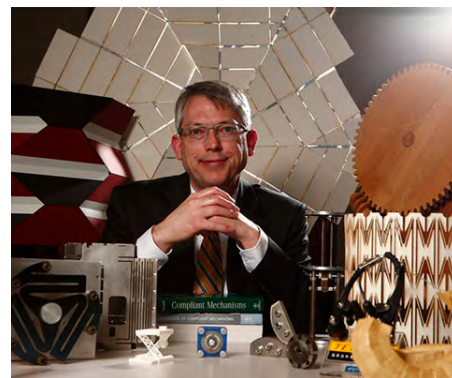
The Mechanical Engineering Department at Brigham Young University pursues the following educational objectives:

- Teach the fundamental concepts of math, science, and mechanical engineering in order 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 in order 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 seven Program Outcomes for the Bachelors Degree. Each student graduating from this program is expected to have the following skills, abilities, and traits:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.



4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

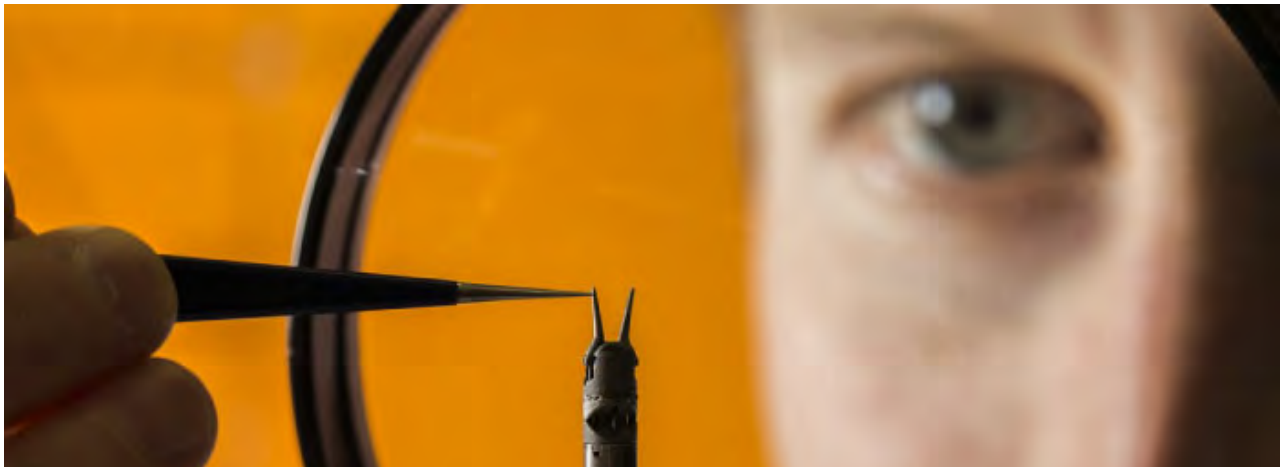
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. .

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The department has articulated seven outcomes of the BS program. Each student graduating from this program is expected to have these skills, abilities, and traits.

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 on the ME website, <https://me.byu.edu/apply>.

Attend the Advisement Overview to learn about program requirements. 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.

Continue taking courses that will keep you on track for graduation. Seek advisement from the department advisor when necessary.

Attend the Career Fairs and speak with recruiters to help you identify an internship during the following summer.

Apply for Capstone (usually this will happen in April).
Watch for notification from within the department bulletins.

Senior year:

Review your Progress Report to determine what classes are still incomplete.

Apply for graduation in MyMap.

Complete your Graduation Survey, and Exit Interview (these are NOT optional).

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. Admission is based on the GPA of the *application courses*. Typically, students with a 3.3 average or higher will get into the major. The *application courses* are:

1. ME EN 191
2. The first physics course taken at BYU from the sequence: PHYSICS 121, PHYSICS 123, Ec En 301
3. The first math course taken at BYU from the sequence: MATH 112, 113, 302, 303, 213, 314, 334
4. The first mechanics course taken at BYU from the sequence: MeEn 101, CeEn 203, CeEn 204

For more information regarding the application process go to: <https://www.me.byu.edu/apply>

What if my grades aren't high enough?

Remember, we are only looking at the application courses for the GPA, so don't panic if you get a C 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 (includes withdraws). We will use the higher grades for your application.

How many times can I apply?

You may apply more than once but be aware of University policy. Students must declare a major by the time they have earned 60 BYU credits (excluding language credit). Once a student has earned 75 BYU credits, they will not be allowed to change their major, unless special permission is granted.





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 for more information.

capstone.byu.edu

What Technical Electives can I take?

The Technical Electives are meant to allow you some 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 at:
me.byu.edu/technical-electives

MECHANICAL ENGINEERING DEPARTMENT - BS Degree Program

SUGGESTED GRADUATION PLAN - 2022-2023

Note: The Progress Report for each student lists their official requirements

Course Key	
Course #	hrs
Course Title	
Prerequisites p: prerequisites	
c: concurrent	
* GE's fulfilled	
When Offered: FWSS	

	Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
University Core	First-Year Writing Requirement 3	American Heritage Requirement 3				Civilization 1 Elective 3	Civilization 2 Elective 3 *Arts or Letters	Remaining Arts or Letters Elective 3
	Religion Cornerstone Requirement 2	Religion Cornerstone Requirement 2	Religion Cornerstone Requirement 2		Religion Cornerstone Requirement 2	Religion Elective 2	Religion Elective 2	Religion Elective 2
Major Requirements	Math 112 Calculus 1 Math 110, 111 *QR & LL FWSS 4	Math 113 Calculus 2 Math 112 FWSS 4	Math 302 Engr Math 1 Math 113 FW 4	Math 303 Engr Math 2 Math 302 FW 4	Stat 201 Statistics Math 112 FWSp 3	Wrtg 316 Tech Writing 1st Yr Writing *ADV WRI FWSS 3	MeEn 475 Integrated Product & Process Design 1 Preqs below F 3	MeEn 476 Integrated Product & Process Design 2 Preqs below W 3
	Phscs 121 Newtonian Mech Math 112 p,c *Phy Sci FWSp 3	Chem 105 General Chemistry Math 110 *Phy Sci FWSS 4	Phscs 123 Waves, Optics, Thermo Phscs 121, Math 112 FWSp 3	EcEn 301 Elem Elec Eng Math 113 FWSp 3	ME Professional Program (Acceptance Required)			
	MeEn 191 New Student Seminar 0.5 FW	MeEn 101 Intro to ME/Statics Phscs 121, Math 112 FWSp 3	CCE 203 Mech of Materials MeEn 101 FW 3	MeEn 273 Computing Math 302 or 314 p,c Math 113 FWSp 3	Me En 335 Dyn systems MeEn 273, CeEn 204 EcEn301 Math 303/334 p,c FW 3	MeEn 312 Fluid Mech MeEn 321, ME 335 Math 303/334 FWSu 3	MeEn 340 Heat Transfer ME 321 FSp 3	Technical Elective 3
	Bio 100 or MMBio 221 PDBio 120 MMBio 240 3 *Bio-Science		CE 204 Dynamics MeEn 101 *Phy Sci FWSp 3	MeEn 250 Materials Science Chem 105 FWSp 3	MeEn 330 Mechatronics EcEn 301, MeEn 273 MeEn 335 p,c FW 3	MeEn 362 Measurements MeEn 330, ME 335 Stat 201 Wrtg 316 p,c FWSu 3	Technical Elective 3	Technical Elective 3
			MeEn 231 Global Ldrshp *Soc Sci & GCA FWSp 3	MeEn 272 CAD FWSp 3	MeEn 382 Mfg Process MeEn 250, MeEn 272 FWSu 3	MeEn 372 Mech Sys Des CEEn 203, MeEn 250 FWSp 3		
Credits	15.5	16.0	18.0	16.0	17.0	17.0	17.0	14.0 Total:130.5

Applying to the Program

- Complete designated courses above or alternate courses listed on me.byu.edu/apply
- Following completion of courses, submit application at me.byu.edu/apply

Alternate Math Courses

- | | |
|--|---|
| Math 213 - Elem Linear Algebra - FWSS | 2 |
| Math 314 - Calc of Sev Variables - FWSS | 3 |
| Math 334 - Differential Equations - FWSS | 3 |

Credits

Technical Elective Courses

- 4 courses (12 hrs) required
- At least 2 ME courses
- No duplicates of required courses
- 3 Credit-hr max in project classes

TE list:

<https://www.me.byu.edu/technical-electives>

Int Product & Process Design Prerequisites

- Must be taken consecutive Fall/Winter semesters
- 475 pre-reqs: MeEn 382, MeEn 330, MeEn 335, MeEn 372
- 476 pre-reqs: MeEn 312, MeEn 362, Me En 340, Me En 475



Can I get an emphasis?

We offer an Emphasis in Aerospace. Learn more at: <https://www.me.byu.edu/aerospace>.

You can also pursue an area of focus by choosing Technical Electives in a specific direction. For example, if you are interested in Robotics, you could take ME EN 437 Kinematics, ME EN 472 Mechanical Systems Design Applications, ME EN 534 Dynamics of Mechanical Systems and/or ME EN 537 Advanced Mechanisms. These classes would give you a foundation pertaining to Robotics. To see the different focus areas see: <https://www.me.byu.edu/technical-elective-focus-areas>

Where can I go for help?

Parents, siblings, and roommates are excellent sources of advice and wisdom, but if you have questions about the ME major, please come to ME faculty or staff.

- We have a caring and knowledgeable Undergraduate Advisor, Miriam Busch, who is always willing to help. You can contact her at mbusch@byu.edu.
- We have a Peer Advisor, who has experienced the program first-hand and can help answer questions and provide support. You can contact her at me-advisement@byu.edu
- We also have an Advisement Center in the College. You can make an appointment there by calling 801-422-4325, or by stopping in 246 EB.
- 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. 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.

Student Opportunities

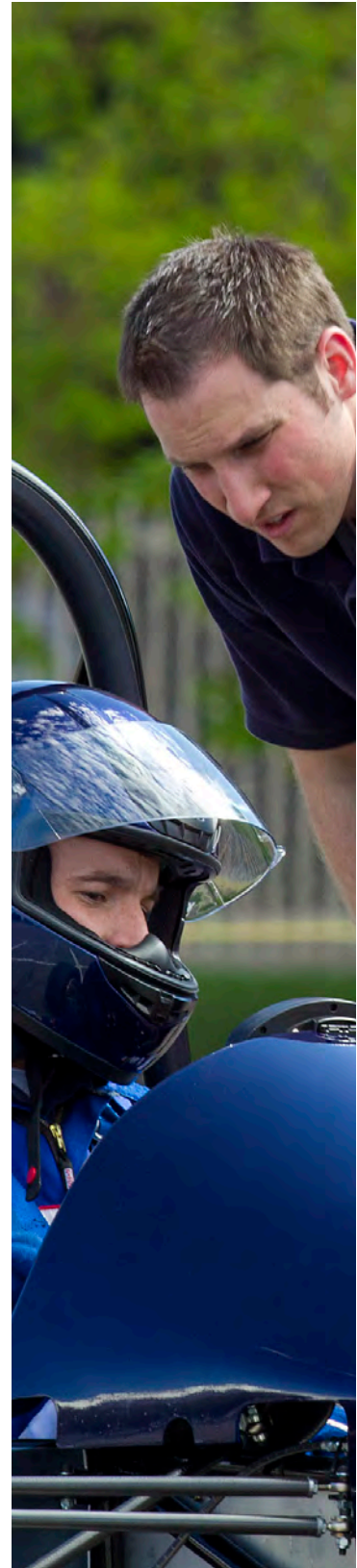


Student Clubs and Societies

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 30,000 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 348,000 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 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.



Getting involved in a student chapter of a professional society is an important part of the whole educational experience.



5. American Nuclear Society (ANS)- the premier organization for those that embrace the nuclear sciences and technologies. ANS is committed to advancing, fostering, and promoting the development and application of nuclear sciences and technologies to benefit society.

6. The Biomedical Engineering Society (BMES) is devoted to developing and using engineering and technology to advance human health and well-being.

7. Society of Hispanic Professional Engineers (SHPE) empowers the Hispanic community to impact the world through STEM awareness, access, support, and development.

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, see: me.byu.edu/clubs-and-societies. BYU also maintains an excellent website for campus clubs at clubs.byu.edu.

Summer Internships

Another important opportunity is an internship. An internship is a career-appropriate job that you take before you have finished your education. The Mechanical Engineering Department does not require students to obtain an internship, nor do we give credit for internships; however, 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.

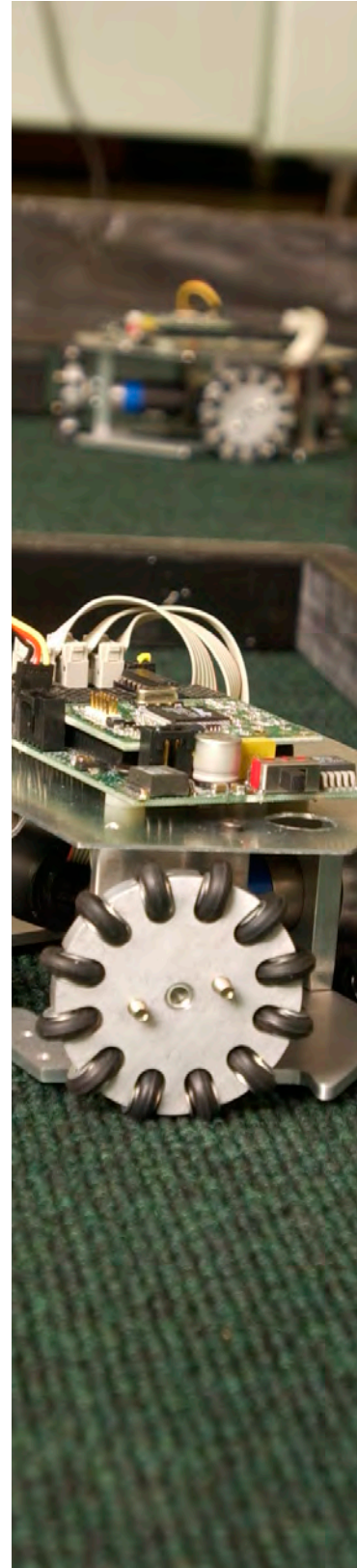
Advantages of an Intern Experience

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 (246 EB). They have information and job listings, as well as a dedicated Career Counselor.
2. The University Career Services Center (2400 WSC) has job listings. They also have many resources to help you research companies to contact.



3. Use BYU Handshake. This is an online resource that connects BYU students to employers and allows users to search job listings, apply for jobs, communicate with recruiters, and schedule on-campus interviews. Log in to handshake.byu.edu.
4. The Mechanical Engineering Department External Relations Coordinator, Llsa Barrager (350 EB), can help you identify opportunities and can also review your resume.
5. Attend the BYU STEM Career Fair. Each Fall and Winter 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. Go prepared.
6. Talk to people, network with friends and relatives, and find out what jobs are available. Get on LinkedIn. 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.



Helpful Resources

My Map Tools

My Map is an academic planning tool. It will give you a summary of your University progress, allows you to plan your courses, and allows you to register for classes. It contains the following additional links:

- Progress Report
- Course Catalog
- Class Schedule
- Academic Calendar
- Financial Center
- Registration Topics

College Advisement

The college advisement center is located in 246 EB and has the following resources:

- Career Counseling
- Major/Minor Selection
- Academic Counseling

Learning Suite

Everything you need to stay on top of your classes
<https://learningsuite.byu.edu>

Math Assistance

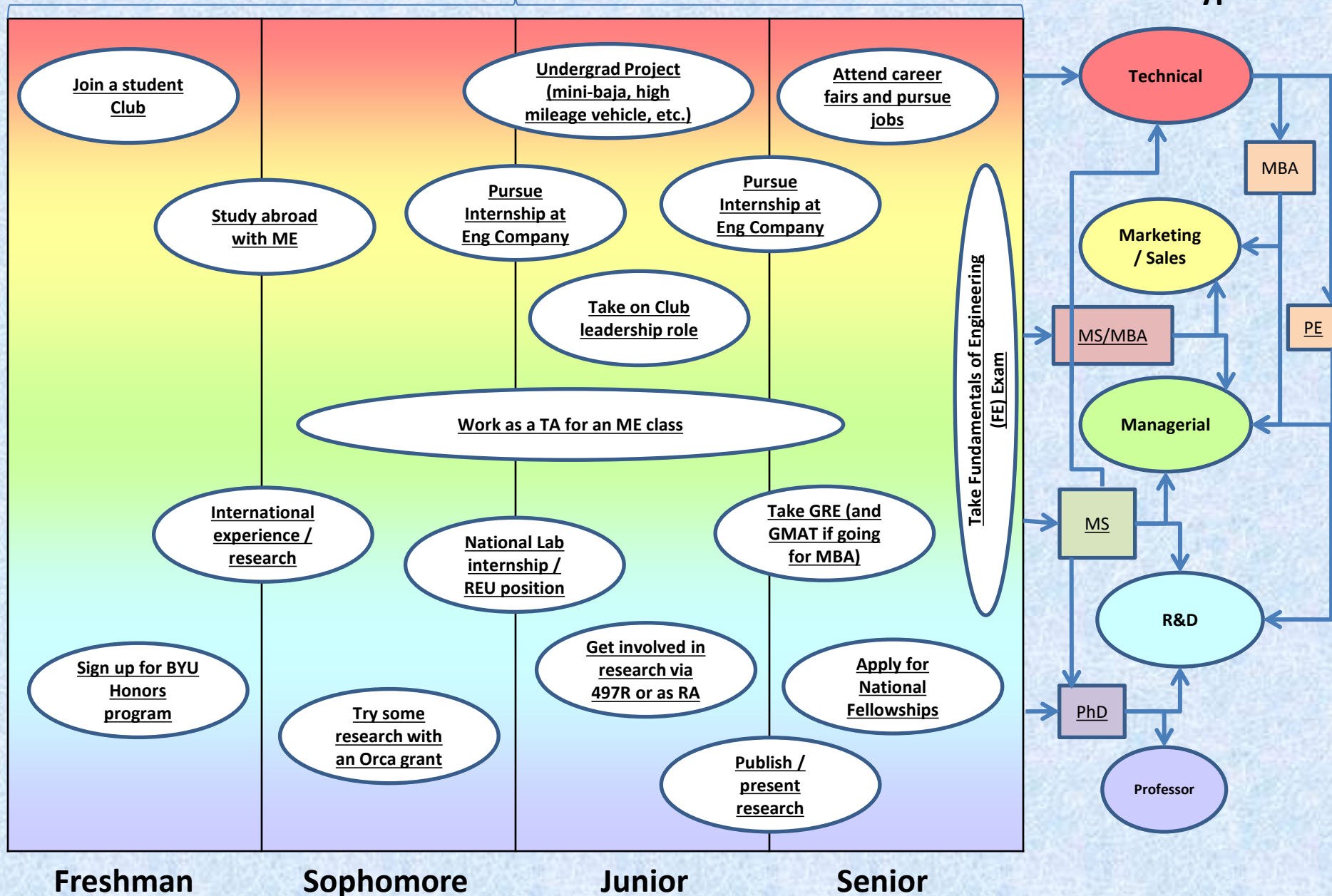
- Math Lab: TMCB 275



Ideas for Different ME Career Trajectories*

BSc in Mechanical Engineering

Career Type:



*Meet with your faculty advisor and undergraduate advisor to develop your own personal map