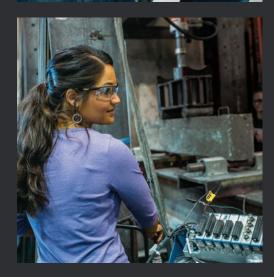
# NORM ASBJORNSON COLLEGE of ENGINEERING MONTANA STATE UNIVERSITY

# ACADEMIC PROGRAMS













The Norm Asbjornson College of Engineering is at the core of MSU's land-grant mission, providing an inclusive, hands-on learning environment that supports academic excellence, strives for innovation in research and serves the community in Montana and beyond.

I'm thrilled to share with you the exciting opportunities available to our students. In the pages that follow, you'll get a glimpse of how our engineering and computer science undergraduates are reaching their goals at MSU and in their fields. With a variety of student support services, handson research opportunities, and courses designed to meet the need for capable and creative professionals, we set our students up for success. I invite you to learn what awaits you at the Norm Asbjornson College of Engineering and how you can be part of our legacy of excellence.

Brett Gunnink, Ph.D., P.E. Dean



#### **UNDERGRADUATE AREAS OF STUDY**

- Biological Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Land Surveying
- Computer Engineering
- Computer Science (STEM interest)
  - Interdisciplinary Option
- Professional Option
- Computer Science (Arts, Humanities or Business interest)
  - Construction Engineering Technology
- Electrical Engineering
- Environmental Engineering
- Financial Engineering
- Industrial & Mgmt. Systems Engineering¹
- Engineering Management
- Mechanical Engineering
- Aerospace
- Building Energy Systems
- Materials
- Mechatronics
- Mechanical Engineering Technology
- ▲ Military Aerospace Studies-Air Force ROTC
- ▲ Military Science-Army ROTC
- Military Studies
- ¹ Master of Science in Industrial & Management Engineering —one additional year
- MajorOption within a major
- Minor ▲ Special program

#### **GRADUATE DEGREES**

- M.Eng. Bioengineering
- M.Eng. Chemical Engineering
- M.Eng. Electrical Engineering
- M.Eng. Mechanical Engineering
  - M.S. Bioengineering
  - M.S. Chemical Engineering
  - M.S. Civil Engineering
  - M.S. Computer Science
  - M.S. Electrical Engineering, Plan A (thesis)
  - M.S. Electrical Engineering, Plan B (professional paper)
  - M.S. Environmental Engineering
  - M.S. Industrial and Management Engineering
  - M.S. Mechanical Engineering
  - M.S. Optics and Photonics Plan A (thesis)
  - M.S. Optics and Photonics, Plan B (professional paper)
- Ph.D. Chemical Engineering
- Ph.D. Computer Science
- Ph.D. Ecology and Environmental Sciences (Interdisciplinary)
- Ph.D. Electrical Engineering
- Ph.D. Engineering—Options in Applied Mechanics, Civil, Environmental, Industrial, and Mechanical
- Ph.D. Materials Science

## **FACTS & STATS**

Academic scores

AVG ACT AVG SAT

Fall 2019 freshman class

Number of faculty

TENURE TRACK

NON-TENURE

AY 2019

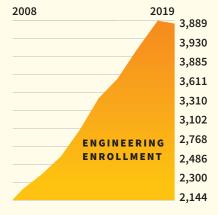
Research expenditures \$18.3 million

FY 2019



#### Top producer of **Goldwater Scholars:**

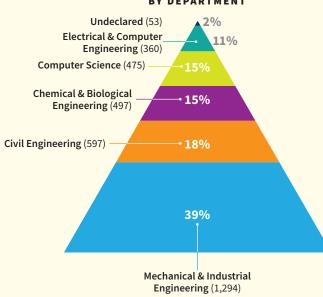
The Goldwater Scholarship is a competitive national award given to math, science and engineering students. MSU has produced 74 Goldwater Scholars—including 10 engineering students in the last five years.-2019





Norm Asbjornson Hall A \$50 million gift from Norm Asbjornson made possible the 110,000-square-foot building, which opened in 2019. Seventeen labs and 9 classrooms foster dynamic interdisciplinary engagement and meaningful student-faculty interaction.

#### UNDERGRADUATE ENROLLMENT BY DEPARTMENT





Cutting edge building technologies helped Norm Asbjornson Hall become one of only 10 buildings in Montana to be certified as LEED Platinum, the U.S. Green Building Council's highest certification.



Named for a generous donor and 1959 MSU electrical engineering alumnus, the Bill Wurst Makerspace will include specialty tools such as 3-D printers for students and faculty to build, test and prototype their big ideas.







### STUDENT SUCCESS

# Student support

#### **ePALS**

The student mentoring program pairs freshmen and sophomores with juniors and seniors who provide guidance about classes, activities, internships and more.

#### **Empower**

Housed within the engineering college, Empower promotes the success of underrepresented minorities and women in STEM fields through scholarships, tutoring and other paths.

#### **Women in Engineering**

Offering professional development and networking opportunities, the Women in Engineering program works to build a community of successful women engineers and computer scientists.

#### Walk-in help centers

The engineering college offers walk-in help centers where students can get one-on-one help with challenging core courses.

#### **Global horizons**

The International Engineering Certificate is a step towards becoming a global computer scientist or engineer – someone who can live, work and perform anywhere. Students work closely with their advisors to turn their engineering study abroad experience or service trip into credit toward the certificate.

#### **Dedicated faculty**

In the Norm Asbjornson College of Engineering, every class is taught by a dedicated faculty member, and one-on-one faculty advising is available to all students for discussing course load, degree planning and career preparation.

# ENGINEERING EXCELLENCE

# Engagement opportunities

#### **Community and connections**

Engineering and computer science students can choose to join any of 38 clubs and organizations within the college, covering everything from robotics to drone racing to professional networking.

#### **Engineers Without Borders**

MSU students have completed more than 30 projects in the Khwisero region of Kenya, including water well projects, sanitation projects, a water pipeline and rainwater catchment systems.

#### **Construction competition**

MSU civil engineering students regularly place among the top teams at a regional competition where they create mock construction bids on real-world projects such as bridges.



**Engineers Without Borders** 

**Opposite, clockwise:** A mechanical engineering student makes final adjustments to a robot excavator to compete in the annual NASA robotic mining competition at Kennedy Space Center. • A civil engineering student conducts surveying on the Yellowstone River to improve native fish passage · Students in the Gianforte School of Computing collaborate on a coding challenge.

# An inclusive college

We remain committed to providing a place for all to realize their potential in engineering and computer science.

- Engineering college Dean Brett Gunnink serves on the President's Commission on the Status of University Women, which continues to work toward the discovery and elimination of institutional barriers to the success of women.
- Housed within the engineering college, Empower promotes the success of underrepresented minorities and women in STEM fields through scholarships, tutoring and more.
- The Women in Engineering program offers professional development and networking opportunities to create a community of successful women engineers and computer scientists.

Women students

203% to 10
increase years

Fall 2019 class: 709 female students

Women faculty on tenure track

26% of total

Fall 2019: 22 tenure-track female faculty

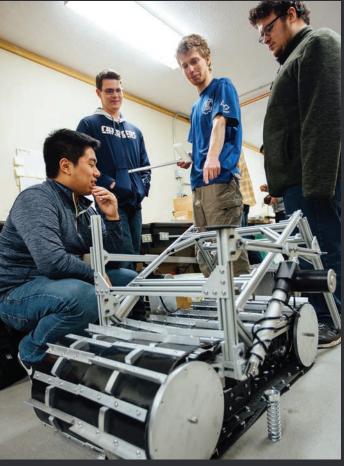
# **EMPOWERING STUDENTS**



The Empower Student Center offers a study area, free tutoring for math and other subjects, laptops with engineering software programs, and more.

Opposite, clockwise: Concrete beam testing lab for structural analysis class. · An experiment to develop new biochemical methods for diagnosing malaria and other diseases · Electrical and mechanical engineering majors work on their lunar excavator for a NASA competition.







#### DEPARTMENT OF CHEMICAL & BIOLOGICAL ENGINEERING



Undergraduate students in environmental biology prepare test tubes to begin researching and incubating single-cell microbes and bacteria collected from geyser basins in Yellowstone National Park that have potential qualities to break down plastics.



Undergraduate student researching new, low-cost method to detect medically significant genetic material.

#### **Research Highlight:**

In an effort to improve the feasibility of a renewable energy source, a team of MSU researchers is exploring a potential breakthrough in producing biofuel from algae with the help of a \$3 million grant from the U.S. Department of Energy.

#### Lighting the way

Chemical engineering students are partnering with their electrical engineering peers and a local nonprofit to design solar-powered bus stops for the local Streamline service in order to provide light, shelter and heat through the seasons.

1	BIOLOGICAL ENGINEERING	
Biological engineers transform natural materials into products such as biodiesel.		
EBIO 100	Intro to Biological Engineering	2
CHMY 141	College Chemistry I	4
University Core Electives 6		
M 171Q	Calculus I	4
University S	Studies or W Core	6
EGEN 102	Intro to Engineer Computer Apps	3
CHMY 143	College Chemistry II	4
M 172Q	Calculus II	4

	CHEMICAL ENGINEERING	
products fi	engineering graduates learn to create rom raw materials, for example using s to create fertilizer.	
ECHM 100	Intro to Chemical Engineering	2
M 171Q	Calculus I	4
University Core Electives		6
CHMY 141	College Chemistry I	4
University Studies or W Core		6
M 172Q	Calculus II	4
CHMY 143	College Chemistry II	4
EGEN 102	Intro to Engineer Computer Apps	3

MINOR

**Biomedical Engineering** 

#### **Career Opportunities**

- Biofuels
- Biomedicine
- Environmental restoration
- Pharmaceuticals

#### **Top Employers**

- BP
- Exxon
- Micron
- Intel
- DuPont
- Pfizer

- American Institute of Chemical Engineers
- Electrochemical Society
- Society for Biological Engineers





**Top to bottom:** 3-D printing creates new ways of studying the interactions of microbes · The Magnetic Resonance Laboratory is used to explore the unique properties of liquids and gels.



Civil engineering students tour the construction site of the new Hyalite Hall on campus during a structural engineering class to gain an understanding of real-world applications structural elements and systems.



Students in the structures laboratory perform concrete beam dynamics testing.

#### **Research Highlight:**

Haley Tupen, a civil engineering graduate student, is partnering with MSU ecology researchers to gather data on the Yellowstone River in order to one day help fish bypass irrigation structures to spawn, feed and access the best winter and summer habitats.

#### World-class work

Housed within the MSU Department of Civil Engineering, the Subzero Research Lab is one of only a few specialized facilities in the world dedicated to snow science and other cold research.

#### **CIVIL ENGINEERING**

Civil engineers provide society with vital infrastructure including roads, buildings, bridges, transit systems and water treatment systems while tackling challenges such as pollution and community planning.

CHMY 141	College Chemistry I	4
M 171Q	Calculus I	4
WRIT 101W	College Writing I	3
University S	eminar	3
University C	Core	3
CHMY 143	College Chemistry II	4
M 172Q	Calculus II	4
PHSX 220	Physics I (with Calculus)	4
ECIV 202	Applied Analysis	1

#### CONSTRUCTION ENGINEERING **TECHNOLOGY**

Construction engineering technology graduates plan and supervise construction for major projects such as highways, buildings and industrial plants.

CHMY 121N	Introduction to General Chemistry	4
DDSN 131	Introduction to Drafting and Design	3
ECNS 101IS	Economic Way of Thinking	3
M 165Q	Calculus for Technology I	3
University S	eminar	3
MECNS 202	Principles of Macroeconomics	3
EMAT 251	Materials Structures & Properties	3
PHSX 205	College Physics I	4
M 166Q	Calculus for Technology II	3
WRIT 101W	College Writing I	3

#### **ENVIRONMENTAL ENGINEERING**

Environmental engineers provide society with solutions that protect public health and natural systems.

CHMY 141	College Chemistry I	4
M 171Q	Calculus I	4
WRIT 101W	College Writing I	3
US 101US	First Year Seminar	3
or CLS 10	DIUS Knowledge and Community	3
or CLS 11	1US Introduction to Public Speaking	3
or HONR	<b>201US</b> Texts and Critics: Knowledge & Imagination I	3
University	Core	6
CHMY 143	College Chemistry II	4
M 172Q	Calculus II	4
PHSX 220	Physics I (with Calculus)	4
ECIV 202	Applied Analysis	1

#### MINORS

Land surveying **Business administration** 

#### **Career Opportunities**

- Construction
- Project management
- Transportation
- Water resources
- Geotechnical
- Structural
- Environmental

- · American Society of Civil Engineers
- Associated General Contractors of America
- Chi Epsilon
- MSU Institute of Transportation Engineers
- · Sigma Lambda Chi

#### DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING



Students who study sky polarization and a variety of other optical phenomena go on to work at NASA and local high-tech companies.



Students working on research projects have the opportunity to use the state-of-the-art cleanrooms in MSU's Montana Microfabrication Facility.

#### **Research Highlight:**

Electrical and computer engineering and computer science students at MSU have helped to create nine satellites launched into space by NASA. One satellite, RadSat, features the hands-on research of more than 50 students and will test radiation-tolerant computing technology developed at MSU.

#### Inform and inspire

Service learning is key to the MSU experience. That's why you'll find computer and electrical engineering students and faculty active with local, regional and international activities including FIRST Robotics, outreach to K-12 education, engineering competitions and summer research programs for underrepresented groups in engineering.

#### **COMPUTER ENGINEERING**

Computer engineers use their understanding of software, electronic circuits, innovation and design to work with modern embedded computer processors that provide the electronic brains for phones, autonomous vehicles, biomedical devices, computer networks and more.

M 171Q	Calculus I	4
EELE 101	Intro to Electrical Fundamentals	3
CLS 101US	Knowledge and Community	3
or COMX 1	L11US Introduction to Public Speaking	3
CSCI 127	Joy and Beauty of Data	4
M 172Q	Calculus II	4
PHSX 220	Physics I (with Calculus)	4
CSCI 112	Programming with C I	4
CSCI 132	Basic Data Structures and Algorithms	4

#### **ELECTRIC ENGINEERING**

Electrical engineers are key contributors at the frontier of science and engineering, using physics, electronics and electromagnetism to work with everything from nanotechnology to smart grids, inside human bodies to deep outer space.

EELE 101	Intro to Electrical Fundamentals	3
M 171Q	Calculus I	4
CLS 101US	Knowledge and Community	3
or COMX 1	.11US Introduction to Public Speaking	3
PHSX 220	Physics I (with Calculus)	4
WRIT 101W	College Writing I	3
M 172Q	Calculus II	4
PHSX 222	Physics II (with Calculus)	4
CSCI 112	Programming with C I	3

#### MINORS

Electrical Engineering · Computer Engineering · Optics · Mechatronics

#### **Career Opportunities**

- Optics
- Robotics
- Digital design
- Audio engineering
- Power systems

#### **Top Employers**

- Hewlett-Packard
- Micron
- Fluke

- Bridger Solar Team
- Institute of Electrical & Electronics Engineers
- MSU student section
- Robocats
- RoboSub Club



MSU engineering students designed a system used by 55 teams across the country to livestream the 2017 total solar eclipse from specialized balloons that reached the edge of outer space.

#### **DEPARTMENT OF MECHANICAL & INDUSTRIAL ENGINEERING**



A mechanical engineering student helps run crash tests of small drone aircraft near Bozeman as part of a research project that could help shape new safety regulations.

#### **Research Highlight:**

MSU mechanical engineering researchers Mark Jankauski and Erick Johnson are studying the physics of flapping insect wings in order to improve drone flight as the devices are designed smaller and smaller

#### **Hands-on learning**

As a requirement of graduation, every engineering college senior completes and presents a hands-on project to the public during the biannual Design Fair. In many cases, students design and build practical solutions for businesses, MSU researchers or government labs.

#### **Career Opportunities**

- Aerospace
- · Automation and robotics
- Automotive
- Biomedical
- Building systems
- Energy
- Finance
- Manufacturing
- Material science
- National laboratories

- American Society of Engineering Management
- American Society of Mechanical Engineers
- Battlebots
- Bobcat Motorsports
- Bridger Solar Team
- Institute of Electrical & Electronics Engineers— MSU student section
- Institute of Industrial and Systems Engineering
- Robocats
- · RoboSub Club

#### FINANCIAL ENGINEERING

Financial engineers work at the intersection of business, economics and engineering to manage market risk, create strategic business opportunities and lower costs for goods and services.

CSCI 127	Joy and Beauty of Data	4
CLS 101US	Knowledge and Community	3
or COMX 1	11US Introduction to Public Speaking	3
M 171Q	Calculus I	4
University C	ore Electives	6
ECNS 251IS	Honors Economics	4
EFIN 101	Introduction to Financial Engineering	1
M 172Q	Calculus II	4
PHSX 220	Physics I (with Calculus)	4
WRIT 101W	College Writing I	3

#### **INDUSTRIAL & MANAGEMENT SYSTEMS ENGINEERING**

IMSEs optimize the ways in which organizations deliver goods and services across a number of fields, including health care, manufacturing, energy and transportation.

EIND 101	Introduction to Industrial & Management Systems Engineering	1
CHMY 141	College Chemistry I	4
M 171Q	Calculus I	4
WRIT 101W	College Writing I	3
University C	Core Electives	6
COMX 111U	S Introduction to Public Speaking	3
EIND 142	Introduction to Systems Engineering	2
M 172Q	Calculus II	4
PHSX 222	Physics II (with Calculus)	4

#### MECHANICAL ENGINEERING

Mechanical engineers transform materials into products that you use every day, creating the machines that we use, developing the energy sources we rely on, and designing environmentallyfriendly buildings where we live and work.

COMX 111US	Introduction to Public Speaking	3
or COMX 1	11US Knowledge and Community	3
M 171Q	Calculus I	4
EMEC 100	Introduction to Mechanical Engineering	1
EMEC 100-C	AE I Engineering Graphics Communications	2
PHSX 220	Physics I (with Calculus)	4
University C	ore Electives	6
CHMY 141	College Chemistry I	4
WRIT 101W	College Writing I	3
M 172Q	Calculus II	4
PHSX 222	Physics II (with Calculus)	4

#### **MECHANICAL ENGINEERING TECHNOLOGY**

Mechanical engineering technology graduates solve design problems big and small in order to improve the operation and performance of mechanical systems.

CHMY 121N	Introduction to General Chemistry	4
or COMX 1	11US Knowledge and Community	3
M 171Q	Calculus I	4
EMEC 100	Introduction to Mechanical Engineering	1
EMEC 100-C	AE I Engineering Graphics Communications	2
PHSX 220	Physics I (with Calculus)	4
University Core Electives		6
CHMY 141	College Chemistry I	4
WRIT 101W	College Writing I	3
M 172Q	Calculus II	4
PHSX 222	Physics II (with Calculus)	4

MINORS

Aerospace · Biomedical · Building Energy Systems · Financial Engineering Materials · Engineering Management · Mechatronics

#### GIANFORTE SCHOOL OF COMPUTING



#### **Career Opportunities**

- Artificial intelligence
- Mobile app development
- Robotics
- Special effects artist
- · Web design

#### **Top Employers**

- SoFi
- Oracle
- Google
- Microsoft
- Boeing

#### **Get Involved**

- Association for Computing Machinery
- · Association for Women in Computing
- Robocats
- Upsilon Pi Epsilon
- Computational Topology & Geometry

The Gianforte School of Computing provides a community atmosphere where students interact in classes and student clubs and on trips to conferences like the Grace Hopper Celebration of Women in Computing.

#### **Research Highlight:**

Indika Kahanda, an assistant professor in the Gianforte School of Computing, is collaborating with the National Alliance on Mental Illness to develop software that can sift through millions of online articles and distill the most relevant information for mental health clinicians.

#### Invest in your future

Computer science students are encouraged to take advantage of professional development opportunities such as all expenses-paid trips to the oSTEM or Grace Hopper conferences or taking part in the annual Spring Break Tech Road Trip.

#### COMPUTER SCIENCE

Because computing is pervasive in today's world, the variety of computing-based careers is limitless. Computer scientists and software engineers use their expertise in computational thinking to advance knowledge and make the world a better place.

Students can choose from a Bachelor of Arts or a Bachelor of Science degree. The B.A. in Computer Science empowers students to pair knowledge of computer science with social sciences, the humanities or business, while the B.S. allows students to master the fundamentals of computing while diving into topics such as artificial intelligence, multimedia and computational biology through professional or interdisciplinary options.

#### PROFESSIONAL OPTION—B.S. M 171Q Calculus I 4 **CSCI 127** Joy and Beauty of Data 3 WRIT 101W College Writing I 3 **University Core and Electives** 7 **University Seminar Core** 3 Calculus II M 172Q CSCI 132 Basic Data Structures and Algorithms

INTERDISCIPLINARY OPTION-B.S.		
M 171Q	Calculus I	4
CSCI 127	Joy and Beauty of Data	4
WRIT 101W	College Writing I	3
University C	ore and Electives	7
CSCI 132	Basic Data Structures and Algorithms	4
M 172Q	Calculus II	4
University Seminar Core		3

B.A. IN COMPUTER SCIENCE		
CSCI 107	Joy and Beauty of Computing	3
STAT 216Q	Introduction to Statistics	3
WRIT 101W	College Writing I	3
University Core		6
Broadening Coursework		6
CSCI 127	Joy and Beauty of Data	3
STAT 217Q	Intermediate Statistical Concepts	3
University Seminar Core		3

# MINORS **Data Science Teaching**



The Gianforte School's Japanese-themed computer lab is open 24/7 and offers a fun, relaxed place for students to work together.



# **NEXT STEPS**

## Three next steps to get started at the Norm Asbjornson College of Engineering

(may be completed in any order)

#### Apply for housing

MSU's housing application opens Oct. 1, priority deadline is March 1. Apply as early as you can so we can accommodate your request. Learn more or apply online at: montana.edu/reslife.

#### Register for Orientation

You can register for a summer orientation session/class registration beginning early spring 2020. Sign up at montana.edu/orientation.

#### Send your transcripts

Your final high school transcripts, and graduation date, should be sent directly from your high school electronically or to: MSU Office of Admissions · 201 Strand Union P.O. Box 172190 · Bozeman, MT 59717-2190

# Engineering scholarships

MSU's Norm Asbjornson College of Engineering is lucky to have very supportive donors, which allows for the awarding of substantial amounts of scholarship money to students seeking an engineering or computer science degree. In 2019-2020, the NACOE was pleased to award almost \$900,000 in scholarships.

Eligibility for need-based scholarships is determined by the MSU Office of Financial Aid. Students who wish to be considered for need-based scholarships must complete the FAFSA student aid application. MSU's priority deadline to file a FAFSA is December 1.

# Financial aid questions

#### **Financial Aid Questions?**

Contact the MSU Office of Financial Aid Services: 406-994-2845 finaid@montana.edu montana.edu/financialaid

#### Important date for financial aid

The priority date for filing your FAFSA is December 1 (for the following fall semester) to be considered for the widest range of financial aid. Apply as early as possible for both financial aid and admission. Fill out the Free Application for Federal Student Aid available at: fafsa.ed.gov. MSU's school code is 002532.

# • Schedule a campus visit

We invite you and your family to experience MSU firsthand and have conversations with students, staff and faculty while you explore the campus. Come see all that Montana State University has to offer by scheduling a personalized visit or attending one of our MSU Friday programs. The Office of Admissions offers campus tours and meetings with admissions counselors any weekday (except holidays) year-round.

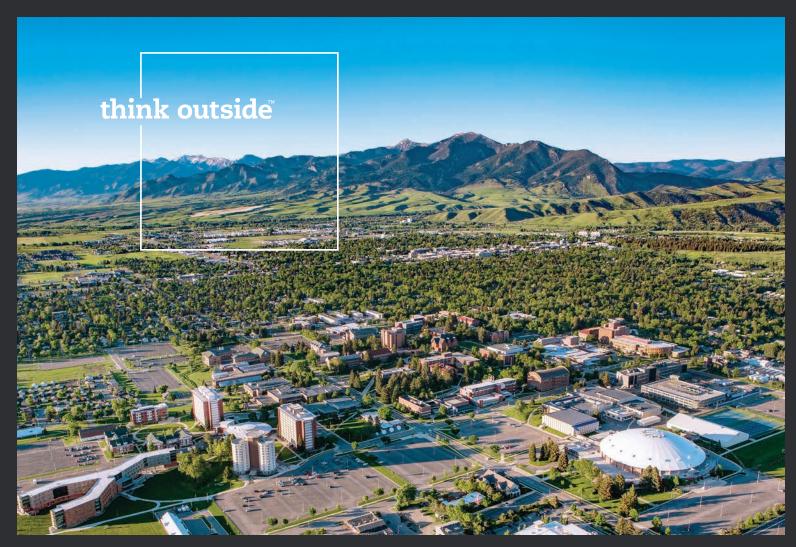
For the best experience, we recommend you schedule your visit two weeks in advance. This will allow us time to schedule requested appointments and send you a confirmation with details about your visit. Register for a campus visit by calling 888-MSU-CATS or online at montana.edu/visit.

## **MSU Friday**

At these day long MSU preview events, you can meet with faculty, hear from current students, explore the campus and learn more about financial aid and scholarships. Find dates, lodging options and registration information at montana.edu/msufriday.

- Join the Class of 2024 to keep up with MSU: fb.com/groups/montanastate2024
- (instagram.com/montanastateuniversity You Tube montana.edu/youtube

Visit montana.edu to learn more about MSU













NORM ASBJORNSON
College of
ENGINEERING

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