

## Mechanical Engineering B.S.

### Contact Information



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Department of Mechanical Engineering

Civil Mechanical 172

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### Faculty

Professors Buck, Dolan, Kalanovic, Kjerengtroen, Korde, Krause, Muci-Kuchler, Langerman; Associate Professor Sagdeo; Assistant Professors Ellingsen, Yoon; Professors Emeritus Gnirk, Pendleton; Instructor Ash.

### Mechanical Engineering

Mechanical engineering (ME) is a very broad field that provides opportunities for interesting and challenging work in every phase of modern technology. The curriculum in the mechanical engineering department is designed to give students a thorough knowledge of the fundamental principles of engineering and science within the major areas of mechanical engineering: thermal science, mechanics, and robotics and controls. Beyond this basic foundation, the curriculum also develops:

1. The various aspects of engineering design including design theory and teamwork;

2. An effective integration of computer technology;
3. Communication skills and effective presentations; and
4. Improved understanding of engineering theory through practical laboratory experience.

In the senior year, students select from course electives that best reflect their interests and career objectives. Students may select courses from one or more of the following general areas:

1. Manufacturing, e.g., control, design, development, and manufacture of diverse equipment and processes;
2. Thermal Science/Energy, e.g., design of power systems and heating/air conditioning systems.
3. Mechanical Systems/Design, e.g., design of machines, structures, and systems.

### Vision

Our vision is to become one of the leading undergraduate mechanical engineering programs in the nation by offering a premier engineering design curriculum and by providing our graduates with a superior educational experience through teaching and learning, research and development, and service and responsibility. Most immediately, our goal is to be recognized as the mechanical engineering program-of-choice within South Dakota and among our peer groups of specialized science and engineering schools across the nation.

### Mission

The mission of the mechanical engineering program is to prepare our graduates for leadership roles in the mechanical engineering profession by

- Offering a quality education to foster a distinctive curriculum accentuating design and project-based learning,
- Committing to individual development while emphasizing the values of teamwork in a culturally diverse, multidisciplinary environment,

- Encouraging undergraduate and graduate research to nurture creative solutions to complex engineering problems.

### **Objectives**

Building upon the department's tradition of excellence requires continual development of active partnerships among the faculty, the students, and our constituents. In keeping with this tradition, the mechanical engineering program produces graduates who are able to perform at a level that meets or exceeds industry expectations. ME students will be able to achieve the objectives listed below within a few years of graduation through attainment of the outcomes listed below at the time of graduation.

**OBJECTIVE 1:** Lead and/or manage effective engineering design analyses

Outcomes

- Apply skills in engineering, science, and mathematics
- Practice effective analysis
- Conduct data analyses and analyses verification

**OBJECTIVE 2:** Lead and/or manage effective engineering design teams

Outcomes

- Apply effective engineering design skills
- Demonstrate teaming proficiency
- Participate in research and professional development

Students may participate in the Cooperative Education Internship Program. In some instances, credits earned during the co-op may be applied toward department elective requirements. The mechanical engineering department does not offer a minor.

The bachelor of science program in mechanical engineering is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place Suite 1050, Baltimore, MD 21202-4012, telephone (410) 347-7700.

### **Mechanical Engineering Laboratories**

There are several undergraduate laboratories in the department, including mechanical systems and instrumentation, thermal and fluid systems, manufacturing, robotic systems, and vibrations. Laboratories are updated with personal computers, peripherals, and data acquisition equipment. Graduate research laboratories and resources include advanced workstation computer facilities, equipment for modern digital controls, machine vision systems, image analysis equipment, structural testing and analysis equipment, compliant structures and computational solid mechanics, fluid mechanics, and heat transfer codes on the workstation facilities.

### **Mechanical Engineering Curriculum/Checklist**

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog. To graduate, students must attain a grade of C or better in all ME core courses (noted below with an \*)

#### **Freshman Year<sup>1</sup>**

##### **First Semester**

MATH 123	Calculus I	4
CHEM 112	General Chemistry I	3
CHEM 112L	General Chemistry I Lab	1
ME 110	Intro to Mechanical Engr.	2
ENGL 101	Composition I	3
PE Physical Education		1
1 Humanities or Social Sciences Elective(s)		3
<b>TOTAL</b>		<b>17</b>

##### **Second Semester**

MATH 125	Calculus II	4
PHYS 211	University Physics I	3
CSC 150	Computer Science I	3
PE Physical Education		1
Humanities or Social Sciences Elective(s)		6
<b>TOTAL</b>		<b>17</b>

#### **Sophomore Year**

##### **First Semester**

EM 214	Statics	3
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ENGL 279	Technical Communications I	3
ME 262	Product Development	2
ME 264/264L	Sophomore Design	2
MATH225	Calculus III	4
	Humanities or Social Sciences Elective(s)	3
<b>TOTAL</b>		<b>17</b>

### Second Semester

ME 221*	Dynamics of Mechanisms	3
ME 211*	Intro to Thermodynamics	3
PHYS 213	University Physics II	3
PHYS 213L	University Physics II Lab	1
Math 321	Differential Equations	4
ME 216*	Intro to Solid Mechanics	3
<b>TOTAL</b>		<b>17</b>

### Junior Year

#### First Semester

MET 231	Properties of Materials Lab	1
MET 232	Properties of Materials	3
ENGL 289	Technical Comm II	3
ME 316*	Solid Mechanics	3
ME 312*	Thermodynamics II	3
EE 301	Intro Circuits, Machines, Syst	4
<b>TOTAL</b>		<b>17</b>

#### Second Semester

ME 313*	Heat Transfer	3
ME 352*	Intro to Dynamic Systems	3
MATH 373	Intro to Numerical Methods	3
ME 322*	Machine Design I	3
ME 351*	Mechatronics and Meas. Syst.	4
ME 331*	Thermo Fluid Dynamics	3
<b>TOTAL</b>		<b>19</b>

### Senior Year

#### First Semester

ME 477	Mechanical Engr. Design I	2
IENG 302	Engineering Economics	3
MATH 381	Probability/Statistics	3
ME 4XX	Mechanical Engr. Elective #1	4
ME 481	Advanced Prod. Dev. Lab I	1
ME 4XX	Mechanical Engr. Elective #2	3
<b>TOTAL</b>		<b>16</b>

#### Second Semester

ME 479	Mechanical Engr. Design II	2
ME 482	Advanced Prod. Dev. Lab II	2
ME 4XX	Mechanical Engr. Elective #3	3

ME 4XX	Mechanical Engr. Elective #4	3
	Humanities or Social Sciences Elective(s)	4
	Free Elective	2
<b>TOTAL</b>		<b>16</b>

### 136 credits required for graduation

\* A grade of C or better required for graduation

### Curriculum Notes

<sup>1</sup> Many courses are prerequisites for other courses, and their sequencing is important. A faculty advisor should be consulted for any deviation from the above schedule.

<sup>2</sup> Music ensemble courses may be substituted for physical education courses for qualified students. Any other substitutions must be approved in advance by the physical education department head.

### Supersonic Wind Tunnel

The Advanced Fluid Mechanics Laboratory at the South Dakota School of Mines and Technology has designed and constructed a supersonic wind tunnel of the indraft type, with an extremely low level of free stream turbulence ( $Tu < 0.01$  percent). The test section area is 16 in<sup>2</sup> (4 inch x 4 inch) with full view schlieren quality glass windows and removable access plugs for ease of model and sensor installation. Novel implementation of a solid desiccant drying system permits a measured test section Mach number of 2.8, with no evidence of condensation, for the current nozzle geometry. A two-stage vacuum system allows for pump down times less than 30 minutes between runs, with an ultimate low pressure capability of several tenths of a psi absolute, which should allow start-up at Mach numbers up to 5 with an appropriately designed nozzle geometry. For pedagogical purposes, the current Mach 2.8 nozzle was also designed to permit schlieren viewing of the flow acceleration from stagnation conditions to the test section supersonic condition along with static pressure measurements at various locations along the length of the nozzle, for comparison with classroom theory. Because of the low free-stream

noise level attendant to the indraft design, the facility is ideally suited for basic research studies of supersonic flow stability and transition mechanisms.

