

MECHANICAL ENGINEERING

Description

Mechanical engineering is a broad field of study that significantly impacts many technologies, including those that expand our energy resources and improve medical care. Mechanical engineers are concerned with all forms of energy conversion and transmission; the flow of fluids and heat; the development, design, manufacturing, and operation of machinery and equipment; material structure and properties; solid and applied mechanics; and transportation processes. The course of study is designed to give the student fundamental preparation to enter the fields of research, design, operation, production, sales, or management.

The mechanical engineering curriculum is structured so that students are well prepared in the fundamental areas of solid mechanics, thermal-fluid sciences, systems and design engineering, and materials engineering. Students can develop an emphasis area of study by concentrating elective courses in specific interdisciplinary areas such as aerospace engineering, automotive engineering, robotics, biomedical engineering, computational methods, manufacturing, nanotechnology and others, depending upon the technical courses available and the interest of the student. Additionally, broader general education requirements are covered through the Achievement-Centered Education (ACE) program (ace.unl.edu); the mechanical engineering curriculum requirements cover ACE areas [1-4,8,10], and students may work with their academic advisor to select courses covering areas [5-7,9].

Mission and Objectives

Mission Statement

The mission of the Department of Mechanical and Materials Engineering at the University of Nebraska is to impact society locally and globally through our educational programs, research, and service, developing knowledge and sharing our expertise in the best traditions of land-grant universities. We strive for excellence in teaching and learning at both the undergraduate and graduate levels; seek to develop novel educational opportunities; grow our public and private support for research and education; and expand our scholarship, outreach, and service.

Accreditation

The Mechanical Engineering (BS) program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the commission's General Criteria and Program Criteria for Mechanical and Similarly Named Engineering Programs.

Program Educational Objectives

Within a few years of graduation, our mechanical engineering graduates are expected to:

1. Have started successful careers based on their education or have completed a professional degree or a graduate degree in engineering or related field.
2. Have begun life-long learning and development in order to remain current in their knowledge and skills and to advance in their careers.
3. Have established a record of professionalism, leadership, respect, and integrity in working to serve humanity and use resources responsibly.

Admission

Admittance to the Degree Program

Students are expected to meet minimum college entrance requirements. After being admitted to the college as pre-mechanical engineering

students, students wishing to pursue a degree in mechanical engineering must further be admitted to the degree program. Students who have completed 43 credit hours applicable to their mechanical engineering degree are considered for formal admission to the mechanical engineering degree program. Typically, this occurs the semester the student is enrolled in MECH 200 Engineering Thermodynamics or MATL 360 Elements of Materials Science. Those exceeding 61 credit hours must receive formal admission to the mechanical engineering degree program if they are to continue to take mechanical engineering courses. Transfer students must have at least 12 credit hours of coursework from the University of Nebraska–Lincoln on record before an application will be considered.

The requirements for admission to the degree program are a major GPA of 2.7 (that is, not counting elective courses), completion of MECH 223 Engineering Statics, no more than four withdrawals and no more than three repeated courses. Those who are not admitted to the degree program the first time are advised of the outcome and are automatically reviewed again at the end of that semester. If after two reviews a student is not admitted to the degree program, the student is advised of other majors, in engineering or elsewhere, in which they may be likely to find success.

Other

Hands-on Opportunities

One major focus of the Department is to provide students with many hands-on opportunities, both within the curriculum (through formal laboratory courses) and through extracurricular activities. Brief descriptions of some of the laboratories in the department are given below.

The Materials Laboratory is designed to study the development of microstructures during processing and to correlate the properties of materials with the observed structures. Undergraduates utilize arc melting facilities for solidification processing and alloy formation, rolling mills for deformation processing, and a variety of furnaces for thermal treatments. Characterization facilities include x-ray diffractometry and optical microscopy, while property measurements are completed using hardness testing (including microhardness), tensile testing, and impact testing facilities. Other facilities associated with the materials laboratory include rapid solidification processing facilities and electron microscopy facilities.

The Measurements Laboratory is associated with the required MECH 380 Mechanical Engineering Measurements course, which includes two hours of lecture and two hours of laboratory work each week. The course covers the fundamentals of mechanical engineering measurements including data analysis (statistics, graphing, spectral analysis); signal conditioning and data readout; and the measurement of length/displacement, rate of rotation, stress/strain, temperature, pressure, fluid velocity, fluid flow rate, vibration/acceleration, and sound. The MECH 380 lab has four workbenches. Each workbench has a set of basic measurement equipment including a digital oscilloscope, an electronic counter, a digital multimeter, a DC power supply, a function generator, and a computer-based data acquisition system consisting of a personal computer with data acquisition software and interfaced analog-to-digital converter and digital counter cards. In addition, on a week-to-week basis, specialized equipment is brought out of the cabinets and set up for each of the nine (some one week, some two week) labs.

The Kinematics and Machine Design Laboratory is a teaching laboratory for undergraduate students. The laboratory consists of equipment and instruments for conducting experiments in kinematics and machine design. One piece of major equipment is the rapid prototyping machine, which accepts design specifications from a computer and forms a prototype of the design using plastic fused deposition. This machine provides the student with experience in design integration from concept to product. Accessories in this laboratory include desktop computers, a wide-carriage printer, and other instruments. Kawasaki also donated a retired robot that is now utilized in this laboratory.

The Thermal Fluids Laboratory involves design, execution, and evaluation of physical experiments in the areas of thermodynamics, fluid mechanics, and heat transfer. There are three major, heavily-instrumented experiments:

1. A two stage air-compressor with intercooling.
2. A versatile air conditioning unit.
3. A Ford gasoline engine with a Superflow water brake dynamometer, supported with a data acquisition system.

The course involves the design, execution, and evaluation of physical experiments in the areas of thermodynamics, fluid mechanics, and heat transfer. In addition, the facilities include "table top" instrumentation for viscosity measurement, measurement of pressure distribution on an airfoil, flow visualization, and head loss across a valve on which students conduct experiments.

The Mechatronics Laboratory is well-equipped for teaching courses in mechatronics, robotics, and controls. It is used primarily for MECH 457 Mechatronic Systems Design and MECH 450 Mechanical Engineering Control Systems Design, but is also used for other courses and by both undergraduate and graduate students working on research projects. The laboratory contains desktop computers, modular robots, digital oscilloscopes, function generators, computer controllers, soldering systems, and many other accessories.

The Department also has computational facilities available to students. The computer lab has a suite of personal computers with a full complement of computing resources available to students.

Research Laboratories. These laboratories, extensions of those described above, are equipped for research in the fields of fluid mechanics, heat transfer, thermodynamics, turbulence, flow visualization, measurements, turbomachinery and engine research, combustion, materials, mechanical design, dynamics, computational, solid and applied mechanics, biomedical engineering, and controls. Many of our undergraduate students gain valuable experience working on research projects under the guidance of professors. These are funded by research grants or the University's UCARE program.

Some of the extracurricular opportunities for students to gain hands-on engineering experience include SAE Baja, SAE Formula (both through Husker Motorsports), NASA microgravity, AIAA competitions, and others.

College Requirements

College Admission

College Entrance Requirements

Students must meet both the University and College of Engineering entrance requirements. The following includes both the University and College of Engineering entrance requirements.

Students must have high school credit for (one unit is equal to one high school year):

1. Mathematics – 4 units: 2 of algebra, 1 of geometry, and 1 of precalculus and trigonometry
2. English – 4 units
3. Natural sciences – 3 units that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management or computer science)
4. Foreign language – 2 units of a single foreign language
5. Social studies – 3 units
6. Students having a composite ACT score of 28 or greater (or equivalent SAT score) will be admitted to the College of Engineering even if they lack any one of the following: trigonometry, chemistry, or physics. Students without test scores who are missing a full unit of trigonometry/pre-calculus/calculus or chemistry or physics will be evaluated through College Review.
7. Students having an ACT score of 19 or less in English (or equivalent SAT score) or a grade lower than B in high school English, must take ENGL 150 Writing and Inquiry or ENGL 151 Writing for Change.

A total of 16 units is required for admission.

Engineering requires that student performance meet one of the following standards: composite ACT of 24, SAT of 1180, ACT Math subscore of 24, SAT Math subscore of 580, or a 3.5 cumulative GPA.

Any domestic first-year student who does not gain admission to Engineering but does gain admission to the University of Nebraska-Lincoln (UNL) will be reviewed through College Review. College Review is conducted through the College Review Committee which considers factors beyond standardized testing. Any first-year student who is not admitted through college review is placed in Pre-Engineering (PENG) with the Exploratory and Pre-Professional Advising Center (Explore Center). Students in the Explore Center can transfer to the College of Engineering once college admission requirements are met.

Students for whom English is not their language of nurture must meet the minimum English proficiency requirements of the University.

Students who lack entrance units may complete precollege training by Independent Study through the University of Nebraska-Lincoln Office of On-line and Distance Education, in summer courses, or as a part of their first or second semester course loads while in the Explore Center or other colleges at UNL.

Students should consult their advisor, their department chair, or Engineering Student Services (ESS) if they have questions on current policies.

Other Admission Requirements

Students who transfer to the University of Nebraska-Lincoln from other accredited colleges or universities and wish to be admitted to the College of Engineering (COE) must meet COE first-year student entrance requirements, have a minimum cumulative GPA of 2.5, and be calculus-ready. Students not meeting either of these requirements must enroll in the Explore Center or another University college until they meet COE admission requirements. Students transferring from UNO, UNL, or UNK to the College of Engineering must be in good academic standing with their institution.

The COE accepts courses for transfer for which a C or better grade was received from colleges outside of the NU system. Although the University

of Nebraska–Lincoln and the College of Engineering in general accepts C- and D grades from the University of Nebraska Kearney and the University of Nebraska Omaha, not all majors in the COE accept such low grades. Students must conform to the requirements of their intended major and, in any case, are strongly encouraged to repeat courses with a grade of C- or less.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 to be readmitted to COE.

College Degree Requirements

Grade Rules

Grade Appeals

In the event of a dispute involving any college policies or grades, the student should appeal to their instructor, and appropriate department chair or school director (in that order). If a satisfactory solution is not achieved, the student may appeal their case through the College Academic Appeals Subcommittee.

Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted at the University of Nebraska–Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at Nebraska in the College of Engineering. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska–Lincoln. This decision should be made in consultation with the student's College of Engineering academic advising team (e.g., ESS professional advisor and the chief faculty advisor for the student's declared degree program). The chief faculty advisor has the final authority for this decision. Eligibility is based on a) enrollment in a community college during the catalog year the student wishes to utilize, b) maintaining continuous enrollment of at least 12 credit hours per semester at the previous institution for at least 2 semesters, and c) continuous enrollment at the University of Nebraska–Lincoln within 1 calendar year from the student's last term at the previous institution. Students must complete all degree requirements from a single catalog year and within the timeframe allowable for that catalog year.

Learning Outcomes

Graduates of the mechanical engineering program will have:

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 above student outcomes have been approved by the ABET Engineering Area Delegation for use beginning with the 2019-20 academic year, and have been adopted by the faculty of the Department of Mechanical and Materials Engineering.

Major Requirements

Mechanical Engineering Core (Mechanics)

MECH 223	Engineering Statics ¹	3
MECH 325	Mechanics of Elastic Bodies	3
MECH 342	Kinematics and Dynamics of Machinery	3
MECH 373	Engineering Dynamics	3
Credit Hours Subtotal:		12
Total Credit Hours		12

Mechanical Engineering Core (Thermal-Fluid Sciences)

MECH 200	Engineering Thermodynamics	3
MECH 300	Thermal Systems and Design	3
or MECH 343	Elements of Machine Design	
MECH 310	Fluid Mechanics	3
MECH 420	Heat Transfer	3
MECH 487	Thermal Fluids Laboratory	2
Credit Hours Subtotal:		14
Total Credit Hours		14

Mechanical Engineering Core (Design)

MECH 130	Introduction to Geometric Modeling and Mechanical Design Practices	3
MECH 230	Introduction to Mechanical Engineering Design	3
or RAIK 163H	Honors: Innovation Processes and Software Engineering Fundamentals	
MECH 446	Mechanical Engineering Design I (Capstone, ACE 10) ²	2
MECH 447	Mechanical Engineering Design II (Capstone, ACE 10) ²	2
MECH 488	Kinematics and Machine Design Laboratory	2
Credit Hours Subtotal:		12
Total Credit Hours		12

General Mechanical Engineering

MATL 360	Elements of Materials Science	4
MECH 321	Engineering Statistics and Data Analysis	3
or RAIK 270H	Statistics and Applications	
MECH 350	Introduction to Dynamics and Control of Engineering Systems	3

MECH 370	Manufacturing Methods and Processes	3
MECH 380	Mechanical Engineering Measurements	3
Credit Hours Subtotal:		16
Total Credit Hours		16

Mechanical Engineering Electives

<i>Technical Elective</i>		
Choose from the list of approved mechanical engineering technical electives	3	
<i>Design Elective</i>		
Choose from the list of approved mechanical engineering design electives	3	
<i>Senior Elective</i>		
Choose from the list of approved mechanical engineering senior electives or choose a 300 or higher engineering, science, or math course with advisor approval	3	
Credit Hours Subtotal:		9
Total Credit Hours		9

General Engineering

BSEN 206 / CONE 206	Engineering Economics (ACE 8)	3
or RAIK 401H	Honors: RAIK Design Studio I	
CSCE 155N	Computer Science I: Engineering and Science Focus	3
or CSCE 155E	Computer Science I: Systems Engineering Focus	
or RAIK 183H	Honors: Computer Problem Solving Essentials	
ECEN 211	Elements of Electrical Engineering I	3
or ECEN 215	Electronics and Circuits I	
ECEN 231	Electrical Engineering Laboratory	1
or ECEN 235	Introductory Electrical Laboratory I	
ENGR 10	Freshman Engineering Seminar ³	0
or CSCE 10	Introduction to the School of Computing	
or ENGR 30	Transfer Student Engineering Seminar	
or RAIK 10	Raikes School Freshman Seminar	
ENGR 20	Sophomore Engineering Seminar ⁴	0
or RAIK 10	Raikes School Freshman Seminar	
Credit Hours Subtotal:		10
Total Credit Hours		10

General Science

CHEM 109A & CHEM 109L	General Chemistry I and General Chemistry I Laboratory	4
CHEM 110A & CHEM 110L	General Chemistry II and General Chemistry II Laboratory	4
PHYS 211	General Physics I ¹	4
PHYS 221	General Physics Laboratory I ¹	1
or PHYS 222	General Physics Laboratory II	
PHYS 212	General Physics II	4
Credit Hours Subtotal:		17

Mathematics

MATH 106	Calculus I ¹	5
MATH 107	Calculus II ¹	4
MATH 208	Calculus III ¹	4

MATH 221	Differential Equations	3
MATH 314	Linear Algebra	3
Credit Hours Subtotal:		19
Total Credit Hours		19

ACE Electives

ACE 1: Writing		3
ENGR 220	Technical Communication I (recommended)	
JGEN 120	Basic Business Communication	
JGEN 200	Technical Communication I	
JGEN 300	Technical Communication II	
ENGL 150	Writing and Inquiry	
ENGL 151	Writing for Change	
RAIK 288H	Honors Business Writing	
ACE 2: Communication		3
ENGR 100	Interpersonal Skills for Engineering Leaders (recommended)	
ALEC 102	Interpersonal Skills for Leadership	
COMM 210	Communicating in Small Groups	
COMM 283	Interpersonal Communication	
COMM 286	Business and Professional Communication	
ACE 3: Math Reasoning		
This requirement is satisfied by MATH 106, MATH 107, or MATH 208		
ACE 4: Science		
This requirement is satisfied by PHYS 211 or PHYS 212		
ACE 5: Humanities		
Choose from the list of approved ACE 5 courses		3
ACE 6: Social Sciences		
Choose from the list of approved ACE 6 courses		3
ACE 7: Arts		
Choose from the list of approved ACE 7 courses		3
ACE 8: Ethics		
This requirement is satisfied by BSEN 206/CONE 206		
ACE 9: Global Awareness		
ENGR 200	Professionalism and Global Perspective (recommended)	3
Or choose from the list of approved ACE 9 courses		
ACE 10: Capstone Experience		
This requirement is satisfied by MECH 446 and MECH 447		
Credit Hours Subtotal:		18
Total Credit Hours		18

¹ Minimum C grade required² The capstone design sequence must be taken in the order shown in the curriculum and should be taken in the last full academic year (fall-spring) of the program (i.e., MECH 446 in the fall and MECH 447 in the spring).³ ENGR 193 may apply for ENGR 10 (students must be in the Kiewit Scholars Program to take the course).⁴ ENGR 493 may apply for ENGR 20 (students must be in the Kiewit Scholars Program to take the course).

Mechanical Engineering Technical Electives

MATL 460	Mechanical Aspects of Materials	3
MATL 461	Materials Laboratory II	3
MATL 462	X-ray Diffraction	3
MATL 465	Applied Physical Metallurgy and Design	3
MATL 466	Materials Selection for Mechanical Design	3
MATL 467	Principles of Powder Metallurgy	3
MATL 468	Failure Analysis: Prevention and Control	3
MATL 469	Physical Materials Systems	3
MATL 470	Thermodynamics of Alloys	3
MATL 471	Electron Microscopy of Materials	3
MATL 472	Kinetics of Alloys	3
MATL 473	Corrosion	3
MATL 474	Extractive Metallurgy	3
MATL 477	Organic and Inorganic Electronic Materials and Devices	3
MATL 492	Special Topics	1-6
MECH 403	Internal Combustion Engines	3
MECH 404	Theory of Combustion	3
MECH 405	Turbomachinery	3
MECH 406	Air Conditioning Systems Design	3
MECH 407	Power Plant Systems Design	3
MECH 408	Heat Exchanger Design	3
MECH 413	Aerodynamics	3
MECH 414	Compressible Flow	3
MECH 415	Two-Phase Flow	3
MECH 416	Engineering Acoustics	3
MECH 421	Elements of Nuclear Engineering	3
MECH 422	Industrial Quality Control	3
MECH 424	Laser Material Processing with Compressible Flow Perspective	3
MECH 425	Solar Energy Engineering	3
MECH 426	Heat Transfer at Nanoscales and in Ultrashort Time Domains	3
MECH 431	Computational Heat Transfer and Fluid Flow	3
MECH 436	Introduction to Continuum Biomechanics	3
MECH 437	Biomedical Device Design	3
MECH 438	Mechanics of Biomaterials	3
MECH 439	Biomaterial Surface Patterning	3
MECH 442	Intermediate Kinematics	3
MECH 444	Intermediate Dynamics of Machinery	3
MECH 445	Mechanical Engineering Design Concepts	3
MECH 448	Advanced Mechanics of Materials	3
MECH 449	Advanced Dynamics	3
MECH 450	Mechanical Engineering Control Systems Design	3
MECH 451	Introduction to Finite Element Analysis	3
MECH 452	Experimental Stress Analysis I	3
MECH 453	Robotics: Kinematics and Design	3
MECH 454	Introduction to Continuum Modeling	3
MECH 455	Vehicle Dynamics	3
MECH 456	Dynamics of Internal Combustion Engines	3

MECH 457	Mechatronic Systems Design	3
MECH 458	Digital Control of Mechanical Systems	3
MECH 472	Additive Manufacturing	3
MECH 474	Manufacturing Systems I	3
MECH 475	Introduction to Mechanical Vibrations	3
MECH 480	Numerical Methods in Engineering	3
MECH 483	Engineering Analysis with Finite Elements	3
MECH 492	Special Topics (excluding topic Making for Innovation)	1-6

Mechanical Engineering Design Electives

MATL 465	Applied Physical Metallurgy and Design	3
MATL 466	Materials Selection for Mechanical Design	3
MATL 468	Failure Analysis: Prevention and Control	3
MECH 406	Air Conditioning Systems Design	3
MECH 407	Power Plant Systems Design	3
MECH 408	Heat Exchanger Design	3
MECH 437	Biomedical Device Design	3
MECH 442	Intermediate Kinematics	3
MECH 445	Mechanical Engineering Design Concepts	3
MECH 450	Mechanical Engineering Control Systems Design	3
MECH 453	Robotics: Kinematics and Design	3
MECH 456	Dynamics of Internal Combustion Engines	3
MECH 457	Mechatronic Systems Design	3
MECH 492	Special Topics (Making for Innovation or Parametric Scripting and Design)	1-6

Senior Electives

MATL 460	Mechanical Aspects of Materials	3
MATL 461	Materials Laboratory II	3
MATL 462	X-ray Diffraction	3
MATL 465	Applied Physical Metallurgy and Design	3
MATL 466	Materials Selection for Mechanical Design	3
MATL 467	Principles of Powder Metallurgy	3
MATL 468	Failure Analysis: Prevention and Control	3
MATL 469	Physical Materials Systems	3
MATL 470	Thermodynamics of Alloys	3
MATL 471	Electron Microscopy of Materials	3
MATL 472	Kinetics of Alloys	3
MATL 473	Corrosion	3
MATL 474	Extractive Metallurgy	3
MATL 477	Organic and Inorganic Electronic Materials and Devices	3
MATL 492	Special Topics	1-6
MECH 300 or MECH 343	Thermal Systems and Design Elements of Machine Design	3
MECH 403	Internal Combustion Engines	3
MECH 404	Theory of Combustion	3
MECH 405	Turbomachinery	3
MECH 406	Air Conditioning Systems Design	3
MECH 407	Power Plant Systems Design	3
MECH 408	Heat Exchanger Design	3

MECH 413	Aerodynamics	3
MECH 414	Compressible Flow	3
MECH 415	Two-Phase Flow	3
MECH 416	Engineering Acoustics	3
MECH 421	Elements of Nuclear Engineering	3
MECH 422	Industrial Quality Control	3
MECH 424	Laser Material Processing with Compressible Flow Perspective	3
MECH 425	Solar Energy Engineering	3
MECH 426	Heat Transfer at Nanoscales and in Ultrashort Time Domains	3
MECH 431	Computational Heat Transfer and Fluid Flow	3
MECH 436	Introduction to Continuum Biomechanics	3
MECH 437	Biomedical Device Design	3
MECH 438	Mechanics of Biomaterials	3
MECH 439	Biomaterial Surface Patterning	3
MECH 442	Intermediate Kinematics	3
MECH 444	Intermediate Dynamics of Machinery	3
MECH 445	Mechanical Engineering Design Concepts	3
MECH 448	Advanced Mechanics of Materials	3
MECH 449	Advanced Dynamics	3
MECH 450	Mechanical Engineering Control Systems Design	3
MECH 451	Introduction to Finite Element Analysis	3
MECH 452	Experimental Stress Analysis I	3
MECH 453	Robotics: Kinematics and Design	3
MECH 454	Introduction to Continuum Modeling	3
MECH 455	Vehicle Dynamics	3
MECH 456	Dynamics of Internal Combustion Engines	3
MECH 457	Mechatronic Systems Design	3
MECH 470	Theory and Practice of Materials Processing	3
MECH 472	Additive Manufacturing	3
MECH 474	Manufacturing Systems I	3
MECH 475	Introduction to Mechanical Vibrations	3
MECH 480	Numerical Methods in Engineering	3
MECH 483	Engineering Analysis with Finite Elements	3
MECH 492	Special Topics	1-6
MECH 498	Research	0-6
MECH 499H	Honors Thesis	1-3
RAIK 370H	Honors: Data and Models II: Data Science Fundamentals	3

MATL 260 Elements of Materials Science**Prerequisites:** CHEM 109A and 109L; PHYS 212; MECH 223 or parallel.**Description:** Relation of atomic, molecular, and crystal structure to the physical, mechanical, and chemical properties of metals, alloys, polymers, and ceramics.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MATL 262**MATL 262 Materials Laboratory I****Prerequisites:** MATL 260 or parallel.**Description:** Engineering behavior of materials with emphasis on macroscopic properties; relationship between these properties, processing history, composition and microstructure. Introduction to the use of metallographic tools used in interpretation.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded**MATL 360 Elements of Materials Science****Prerequisites:** CHEM 109A and 109L; PHYS 212; MECH 223 or parallel.**Description:** Relation of atomic, molecular and crystal structure to the physical, mechanical and chemical properties of metals, alloys, polymers and ceramics. Experience in investigation of properties of engineering materials.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded**Prerequisite for:** MECH 343; MECH 370**Course and Laboratory Fee:** \$30**MATL 460 Mechanical Aspects of Materials****Crosslisted with:** MATL 860**Prerequisites:** MECH 325 and MATL 360, or equivalent.**Description:** Emphasizes those principles at the atomistic or molecular level that relate mechanical properties and behavior of different classes of materials to their structure and environment.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MATL 875; MATL 960; MATL 962**MATL 461 Materials Laboratory II****Crosslisted with:** MATL 861**Prerequisites:** MATL 360.**Description:** Application of scientific principles in the laboratory to the analysis of materials problems and selection of engineering materials.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Course and Laboratory Fee:** \$20**MATL 462 X-ray Diffraction****Crosslisted with:** MATL 862**Prerequisites:** PHYS 212.**Description:** Principles of crystallography. Production and properties of X-rays. Interaction of X-rays with atoms and the nature of diffraction (direction and the intensities of diffracted beams). Diffraction patterns and intensity measurements.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded

MATL 463 Introduction to Materials for Nuclear Energy Systems

Crosslisted with: MATL 863

Prerequisites: MATL 260 or MATL 360 or equivalent

Description: Introduction to materials in nuclear engineering with a focus on power generation, including concepts related to components of nuclear power stations, generation-IV fission reactors, materials for nuclear reactors, degradation of mechanical properties in irradiation environments, and fusion reactors.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 465 Applied Physical Metallurgy and Design

Crosslisted with: MATL 865

Prerequisites: MATL 360 or equivalent.

Description: Principles of alloying; alloy selection; modification of the physical properties of structural alloys by thermal, mechanical, and chemical treatment; solidification and joining phenomena.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 466 Materials Selection for Mechanical Design

Crosslisted with: MATL 866

Prerequisites: MATL 360 and MECH 325.

Description: Rational selection procedure for the most suitable materials for each particular mechanical design. Introduction of materials selection charts and the concept of materials performance indices. Case studies in mechanical design, taking materials selections, shape and process into account. Projects on materials selection at the design concept and the design embodiment stages.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 467 Principles of Powder Metallurgy

Crosslisted with: MATL 867

Prerequisites: MECH 200; MECH 325; MATL 360 or equivalent.

Description: Basic principles of powder metallurgy, with emphasis on methods of producing metal powders, determination of their characteristics; the mechanics of powder compaction; sintering methods and effects; and engineering applications.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 468 Failure Analysis: Prevention and Control

Crosslisted with: MATL 868

Prerequisites: MECH 325; MATL 360 or equivalent.

Description: Metallurgical tools for analysis of failures; types and modes of failures; sources of design and manufacturing defects. Case histories utilized to illustrate modes of failures and principles and practices for analysis. Design concepts and remedial design emphasized with these case studies. Several projects involving case analyses and design by students included.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 469 Physical Materials Systems

Crosslisted with: MATL 869

Prerequisites: PHYS 212 and MATL 360.

Description: Development of the principles controlling the formation of the structure of engineering materials. Phase diagrams, diffusion, interfaces and microstructures, solidification and diffusional transformation and diffusionless transformations.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 470 Thermodynamics of Alloys

Crosslisted with: MATL 870

Prerequisites: MATL 360 and MECH 200, or equivalent; MATH 208 or parallel.

Description: Materials thermodynamics of closed systems, introduction to liquid and solid solution alloys, relationship to gas phase, application to binary systems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MATL 875; MATL 960; MATL 970; MATL 972

MATL 471 Electron Microscopy of Materials

Crosslisted with: MATL 871

Prerequisites: PHYS 212.

Description: Introduction to electron beam instruments. Electron interactions with materials. Basic aspects of electron diffraction, image formation and spectrum generation by materials. Acquisition and analysis of images, diffraction patterns and spectral data. Resolution and sensitivity limits of electron probe methods. Practical experience in the use of electron microscopes for characterization of materials.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 472 Kinetics of Alloys

Crosslisted with: MATL 872

Prerequisites: MATL 360 or equivalent; MATH 221/MATH 821.

Description: Kinetics of gas-liquid-solid reactions in alloy systems; analysis of diffusion models applicable to such systems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 473 Corrosion

Crosslisted with: MATL 873

Prerequisites: CHEM 109A and CHEM 109L or equivalent.

Description: Fundamentals of corrosion engineering, underlying principles, corrosion control, and materials selection and environmental control.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MATL 474 Extractive Metallurgy**Crosslisted with:** MATL 874**Prerequisites:** MATL 360 and MECH 200 or equivalent.**Description:** Unit operations and processes utilized in production of ferrous, nonferrous, and refractory metals. Examples of production techniques for metal bearing ores, scrap metals, and domestic waste. Control of impurity and alloy content and their relationship to physical properties.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 477 Organic and Inorganic Electronic Materials and Devices****Crosslisted with:** MATL 877**Prerequisites:** Permission**Description:** The course introduces the optical and electronic processes in inorganic and organic molecules and polymers that govern the behavior of practical organic electronic and optoelectronic devices.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MATL 492 Special Topics****Crosslisted with:** MATL 892**Description:** Special topics in materials engineering and related areas.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 24**Grading Option:** Graded**MECH 100 Introduction to Mechanical Engineering****Description:** Overview of mechanical engineering. Introduction to problem layout, and development of basic skills required to solve mechanical engineering problems. Collection, manipulation and presentation of engineering data.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded**MECH 130 Introduction to Geometric Modeling and Mechanical Design Practices****Description:** Principles and accepted practices of geometric design. Computer generation of 2D and 3D models for mechanical systems. Introduction to engineering design practices such as specifications, dimensioning, and tolerance.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 230; MECH 342; MECH 381**Course and Laboratory Fee:** \$25**MECH 200 Engineering Thermodynamics****Prerequisites:** MECH 223.**Description:** First and Second Laws of Thermodynamics, properties of gases and vapors, and cycles. Sources of energy and its conversion to work.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** AGEN 344, BSEN 344; AREN 310; AREN 404; MECH 300; MECH 330; MECH 446; MECH 446H; MECH 487**MECH 200H Honors: Engineering Thermodynamics****Prerequisites:** Good standing in the University Honors Program or by permission; PHYS 212; MECH 223. Credit toward the degree cannot be earned in both MECH 200 and MECH 200H.**Description:** First and Second Laws of Thermodynamics, properties of gases and vapors, and cycles. Sources of energy and its conversion to work. Honors students will be expected to study beyond the students in the normal sections and do a special project.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** AGEN 344, BSEN 344; AREN 310; AREN 404; MECH 300; MECH 330; MECH 446; MECH 446H; MECH 487**MECH 220 Statics****Prerequisites:** MATH 106.**Description:** Fundamental concepts, equilibrium of force systems, analysis of simple frames and trusses. Centroid and moments of inertia and friction.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 324**Course and Laboratory Fee:** \$10**MECH 223 Engineering Statics****Prerequisites:** MATH 107 (grade of C or better), PHYS 211 (grade of C or better)**Description:** Action of forces on engineering structures and machines. Force systems, static equilibrium of frames and machines. Friction, center of gravity, moment of inertia, vector algebra.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** AGEN 324, BSEN 324; BSEN 410; CIVE 310; CIVE 310H; CIVE 361; CIVE 371; MATL 260; MATL 360; MECH 200; MECH 200H; MECH 324; MECH 325; MECH 325H; MECH 373; MECH 373H

MECH 223H Honors: Engineering Statics

Prerequisites: Good standing in the University Honors Program or by permission; MATH 107 and PHYS 211. Credit toward the degree cannot be earned in both MECH 223 and MECH 223H.

Description: Bodies in equilibrium. Vector algebra, equivalent force systems, distributed loads, and center of gravity. Analysis of trusses, frames, and machines. Friction, wedges, screws, and belts. Area moments of inertia.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: AGEN 324, BSEN 324; CIVE 310; CIVE 310H; CIVE 361; CIVE 371; MATL 260; MATL 360; MECH 200; MECH 200H; MECH 324; MECH 325; MECH 325H; MECH 373; MECH 373H

MECH 230 Introduction to Mechanical Engineering Design

Prerequisites: MECH 130, MECH 325

Description: Introduction to formalized engineering design processes and methodology, selection of common mechanical components, and practice of teamwork and problem solving in the context of mechanical engineering.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

Prerequisite for: MECH 446; MECH 446H

MECH 250 Mechanics I

Prerequisites: PHYS 211.

Notes: Parallel: MATH 208. For electrical engineering majors.

Description: Force actions in static coplanar systems with applications to engineering structures and machines. Resultants, moments, couples, equivalent force systems, vector algebra. Static equilibrium conditions and equations.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

Prerequisite for: MECH 351

MECH 300 Thermal Systems and Design

Prerequisites: MECH 200, CSCE 155N

Description: Applications of control-volume analysis (mass, energy, and momentum), both transient and steady; mixtures of gases and vapors; introduction to combustion; thermodynamic relations and establishment of data banks of thermal properties; applications of computer-aided engineering to processes and cycles; methodologies and case studies for thermal systems design; execution of small-scaled design projects.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: SPRING

MECH 310 Fluid Mechanics

Prerequisites: MECH 373; MATH 221

Notes: Parallel: MECH 200, or BSEN 244 or by permission for non-ME students.

Description: Fluid statics, equations of continuity, momentum, and energy dimensional analysis and dynamic similitude. Applications to: flow meters; fluid pumps and turbines; viscous flow and lubrication; flow in closed conduits and open channels. Two-dimensional potential flow.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

Prerequisite for: AGEN 325, BSEN 325; AGEN 344, BSEN 344; CIVE 310L; CIVE 351; MECH 311; MECH 380; MECH 446; MECH 446H

MECH 310H Honors: Fluid Mechanics

Prerequisites: MECH 373; MATH 221. Credit toward the degree cannot be earned in MECH 310 and MECH 310H.

Notes: Parallel: MECH 200, or BSEN 244 or by permission for non-ME students.

Description: Fluid statics, equations of continuity, momentum, and energy dimensional analysis and dynamic similitude. Applications to: flow meters; fluid pumps and turbines; viscous flow and lubrication; flow in closed conduits and open channels. Two-dimensional potential flow. Advanced topics/project.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

Prerequisite for: MECH 380; MECH 446H

MECH 311 Fluid Mechanics Laboratory

Prerequisites: MECH/CIVE 310 or parallel.

Description: Fluid mechanics experiments and demonstrations. Conservation principles; determination of fluid properties, velocity, pressure, and flow measurements; pipe flow; open channel flow; and instrumentation techniques.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded

Course and Laboratory Fee: \$20

MECH 318 Applied Linear Algebra and Computational Methods

Prerequisites: MATH 208; MATH 221 or parallel; CSCE 155N or equivalent.

Notes: This course is a substitute for MATH 314 for mechanical engineering students.

Description: Application-based linear algebra concepts and introduction to numerical computations using Matlab. Topics include: linear systems and numerical solvers; eigenvalue and eigenvector computations; methods for root finding and curve fitting; norms and convergence of numerical methods; numerical integration, differentiation, and initial-value ODE problems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

MECH 321 Engineering Statistics and Data Analysis**Prerequisites:** MATH 208**Description:** An applications-oriented course for formulating and solving engineering statistical problems. Includes Descriptive statistics, probability distributions, variability, sampling, confidence intervals, tests of significance, basics of statistical process control, and design of experiments.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** BLAW 371H; BLAW 372; CIVE 950; ECEN 850, ECEN 450; ECON 311A; ECON 311B; ECON 312A; ECON 312B; ECON 315; ECON 417; MECH 343; MECH 380; MRKT 350**MECH 324 Strength of Materials****Prerequisites:** MECH 220 or MECH 223.**Notes:** For students in architecture and construction management.**Description:** Stress and strain analysis in elastic materials. Use of properties of materials in the analysis and design of welded and riveted connections, statically determinate and indeterminate flexure members, columns. Combined stresses, axial, eccentric and torsional loading. Observations of laboratory tests for axially loaded specimens. Introduction to shear and moment diagrams.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 325 Mechanics of Elastic Bodies****Prerequisites:** MECH 223 (grade of C or better), MATH 208**Description:** Concept of stress and strain considering axial, torsional, and bending forces. Shear and moments. Introduction to combined stresses and column theory.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** AGEN 443; CIVE 331; CIVE 341; CIVE 342; MECH 230; MECH 330; MECH 343; MECH 370; MECH 910**MECH 325H Honors: Mechanics of Elastic Bodies****Prerequisites:** Good standing in the University Honors Program or by permission; MECH 223 or 223H; MATH 208. Credit toward the degree cannot be earned in both MECH 325 and MECH 325H.**Description:** Introduction to the mechanics of elastic bodies. Concepts of stress and strain. Extension, bending, and torsion. Shear and moment diagrams. Principal stresses. Deflection of statically determinate and indeterminate beams. Buckling of columns. Special advanced topics.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** AGEN 443; CIVE 331; MECH 230; MECH 330; MECH 343; MECH 370**MECH 330 Mechanical Engineering Analysis****Prerequisites:** MATH 221; CSCE 155N; MECH 325; MECH 373; MECH 200.**Description:** Conceptual modeling of mechanical engineering systems. Analytical exploration of engineering behavior of conceptual models. Case studies drawn from mechanical engineering problems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 350**MECH 342 Kinematics and Dynamics of Machinery****Prerequisites:** BSEN 130 or MECH 130; MECH 373**Description:** Analysis of the motions of linkage and cam mechanisms. Methods of design of linkage and cam mechanisms. Gear theory. Analysis and design of ordinary and planetary gear trains. Determination of static and dynamic forces in machines. Balancing of machines. Flywheel design. Dynamics of cam mechanisms. Vibration of machines.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 343; MECH 488**Course and Laboratory Fee:** \$5**MECH 343 Elements of Machine Design****Prerequisites:** MECH 325; MECH 342 or parallel; MATL 360; MECH 321 or STAT 380 or parallel.**Description:** Design of machine elements under different conditions of loading. Design work includes a project of broader scope (done primarily out of class) requiring a breadth of knowledge. Failure theories for static and dynamic loading of bolts, springs, bearings, and shafts.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** SPRING**MECH 350 Introduction to Dynamics and Control of Engineering Systems****Prerequisites:** MECH 373; ECEN 211; CSCE 155N; MATH 314 or parallel.**Description:** Unified treatment of the dynamics and control of engineering systems. Emphasis on physical aspects, formulation of mathematical models, application of various mathematical methods, and interpretation of results in terms of the synthesis and analysis of real systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** MECH 380; MECH 446; MECH 446H**MECH 351 Mechanics II****Prerequisites:** MECH 250.**Notes:** For electrical engineering majors.**Description:** Application of Newton's laws to engineering problems involving coplanar kinematics and kinetics of particles. Work, energy, impulse, and momentum. Conservative systems. Periodic motion.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded

MECH 370 Manufacturing Methods and Processes

Prerequisites: MATL 360; and MECH 325.

Description: Introduction to traditional and modern manufacturing processes and methods to include: foundry; forming processes; welding; metal removal theory and practices; modern manufacturing systems and automation; and economics of process selection.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 373 Engineering Dynamics

Prerequisites: MECH 223 (grade of C or better), MATH 208.

Description: Force action related to displacement, velocity, and acceleration of rigid bodies. Kinematics of plane motion, kinetics of translation and rotation. Mass moment of inertia, vibration, work, energy and power, impulse and momentum.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: BSEN 410; MECH 310; MECH 310H; MECH 330; MECH 342; MECH 350

MECH 373H Honors: Engineering Dynamics

Prerequisites: Good standing in the University Honors Program or by permission; MECH 223 or 223H; MATH 208. Credit toward the degree cannot be earned in both MECH 373 and MECH 373H.

Description: Motion of particles and rigid bodies under the action of forces and moments. Kinematics of plane motion: displacement, velocity, and acceleration. Kinetics of translation and rotation; work, energy and power; impulse, momentum and impact. Introduction to vibration analysis.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MECH 310; MECH 310H; MECH 330; MECH 342; MECH 350

MECH 380 Mechanical Engineering Measurements

Prerequisites: ECEN 231; JGEN 200 or JGEN 300 or JGEN 120 or ENGL 151; MECH 321 or STAT 380 or parallel; MECH 350 and MECH 310, or parallel.

Description: Theory, statistics, applications and design of mechanical engineering experiments.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

Prerequisite for: MECH 487; MECH 488

Course and Laboratory Fee: \$20

MECH 381 Elements of Computer-Aided Design

Prerequisites: MATH 221; MECH 130 or CSCE 155N

Description: Principles and techniques currently used for the computer-aided design (CAD). Applications of interactive graphics devices for drafting, design, and analysis. Modelling and analogy of engineering systems. Elementary finite element, Bode, and numerical analyses. CAD case studies and term project.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Course and Laboratory Fee: \$25

MECH 399 Undergraduate Research and Thesis

Prerequisites: Permission.

Description: Engineering design or laboratory investigation that an undergraduate is qualified to undertake.

Credit Hours: 1-5

Min credits per semester: 1

Max credits per semester: 5

Max credits per degree: 6

Grading Option: Graded

Course and Laboratory Fee: \$25

MECH 403 Internal Combustion Engines

Crosslisted with: MECH 803

Prerequisites: MECH 300 or equivalent.

Description: Basic cycle analysis and engine types, fundamental thermodynamics and operating characteristics of various engines are analyzed, combustion processes for spark and compression-ignition engines, fuels, testing procedures, and lubrication systems are evaluated. Emphasis on the thermodynamic evaluation of the performance and understanding the basic operation of various engine types.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 404 Theory of Combustion

Crosslisted with: MECH 804

Prerequisites: MECH 300 and MECH 420/MECH 820.

Description: Stoichiometric analysis of combustion processes. Energy transfer, flame propagation, and transformation velocities during combustion. Combustor applications and design considerations. Emission formation and methods of control.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MECH 904

MECH 405 Turbomachinery

Crosslisted with: MECH 805

Prerequisites: MECH 300 and MECH 310/CIVE 310

Description: Thermodynamic analysis and design of axial and radial flow turbines, compressors, and pumps. Fundamentals of the operating characteristics and performance parameters of turbomachines will be evaluated. Cavitation and blade element theory.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 406 Air Conditioning Systems Design**Crosslisted with:** MECH 806**Prerequisites:** MECH 300 or equivalent.**Description:** Application of thermodynamic and fluid dynamic principles to the design of air conditioning systems. Comprehensive design project is an integral part of the course.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 407 Power Plant Systems Design****Crosslisted with:** MECH 807**Prerequisites:** MECH 300 or equivalent.**Description:** Application of thermodynamic and fluid dynamic principles to the design of Power Plants. Comprehensive design project is an integral part of the course.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 408 Heat Exchanger Design****Crosslisted with:** MECH 808**Prerequisites:** MECH 300 or equivalent.**Description:** Design methodology for various heat exchangers employed in mechanical engineering. Introduction to computer-aided design as applied to heat exchangers. Practical exercises in actual design tasks.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 413 Aerodynamics****Crosslisted with:** MECH 813**Prerequisites:** MECH 200 and MECH 310/CIVE 310.**Description:** Subsonic and supersonic air flow theory, dynamics of flight, performance parameters, rotoranalysis, and special topics.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 414 Compressible Flow****Crosslisted with:** MECH 814**Prerequisites:** MECH 300 and MECH 310/CIVE 310.**Description:** Analysis of the flow of compressible fluids by means of the momentum equation, continuity equation, and the laws of thermodynamics and some application of thermodynamic laws to incompressible fluids.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 415 Two-Phase Flow****Crosslisted with:** MECH 815**Prerequisites:** MECH/CIVE 310; MECH 380 or parallel.**Description:** Transport phenomena of homogeneous and heterogeneous types of mixtures such as solid-liquid, liquid-liquid, and liquid-gas. Properties of components and mixtures. Flow induced vibrations and parameter distributions. Optimization and design problems in multiphase systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 416 Engineering Acoustics****Crosslisted with:** MECH 816**Prerequisites:** MECH 310 and MATH 221/MATH 821.**Description:** Transverse and longitudinal traveling waves. Acoustic wave equation of fluids. The reflection, transmission, radiation, reception, absorption, and attenuation of sound. Acoustic cavities and waveguides. Sound propagation in pipes, resonators and filters.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 420 Heat Transfer****Crosslisted with:** MECH 820**Prerequisites:** MECH 310**Description:** Heat transfer by conduction, convection, and radiation. Correlation of theory with experimental data and engineering design.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 404, MECH 804; MECH 487; MECH 922; MECH 923; MECH 924**MECH 421 Elements of Nuclear Engineering****Crosslisted with:** MECH 821, ENGR 421**Prerequisites:** ENGR 300 or ENGR 301 or ENGR 310; MATH 208/ MATH 208H; and PHYS 212/PHYS 212H**Description:** Survey of nuclear engineering concepts and applications. Nuclear reactions, radioactivity, radiation interaction with matter, reactor physics, risk and dose assessment, applications in medicine, industry, agriculture, and research.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** ENGR 410; ENGR 420**MECH 422 Industrial Quality Control****Crosslisted with:** MECH 822**Prerequisites:** MECH 321 or STAT 380**Description:** Statistical process control and quality assurance techniques in manufacturing. Control charts, acceptance sampling, and analyses and design of quality control systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR

MECH 424 Laser Material Processing with Compressible Flow Perspective

Crosslisted with: MECH 824

Prerequisites: Permission.

Description: Fundamentals of laser material processing. Laser material interactions from the compressible flow perspective. Analytical, semi-analytical, and numerical approaches.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 425 Solar Energy Engineering

Crosslisted with: MECH 825

Prerequisites: MECH 420 or permission.

Description: Conversion of solar energy into more useful forms with emphasis on environmental heating and cooling applications. Includes solar energy availability, solar collectors and design, solar systems and their simulation and solar economics.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 426 Heat Transfer at Nanoscales and in Ultrashort Time Domains

Crosslisted with: MECH 826

Prerequisites: MECH 420.

Description: Heat transfer in nanoscale and nanostructured materials. Heat transfer in ultrafast laser materials processing.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 428 Analysis of Thermal Data

Crosslisted with: MECH 828

Prerequisites: MECH 420 or parallel.

Description: Indirect measurement of thermal properties and heat flux are explored with various methods, and optimization, with examples drawn from engineering practice.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

MECH 431 Computational Heat Transfer and Fluid Flow

Crosslisted with: MECH 831

Prerequisites: MECH 310; MATH 314; MECH 420 or parallel.

Description: Finite difference methods for steady and transient diffusion and convection-diffusion problems. Finite volume technique for the solution of multi-dimensional fluid flow, and heat and mass transfer problems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MECH 932

MECH 433 Microscale Transport Phenomena in Biosystems

Crosslisted with: MECH 833

Prerequisites: MECH 310

Notes: Knowledge of engineering mathematics to describe physical systems, especially transport phenomena

Description: An introduction to transport phenomena with an emphasis on applying the principles of mass transfer and fluid dynamics to microscale biosystems including microorganisms. Topics include Brownian motion, diffusion-based mass transfer, cellular receptors, Taylor dispersion, bacterial diffusion, chemotaxis, low Reynolds number fluid dynamics, hydrodynamics of swimming microorganisms, surface tension and microfluidics.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 434 Facility Planning and Design

Notes: introductory knowledge of ergonomics

Description: Design, analysis and layout of facilities: queuing, material handling systems, material flow analysis, systematic layout planning and design of warehouse facilities.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 435 Introduction to Cell Mechanics

Crosslisted with: MECH 835

Notes: Knowledge of calculus and basic physics to describe physical systems

Description: An introduction to cell mechanics with an emphasis on application of fundamental mechanics and various experimental methods to understanding cell mechanics. Topics include cell structure, basic solid/fluid/statistical mechanics, biopolymer mechanics, cytoskeletal network mechanics, cellular adhesion and motility, and mechanobiology.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 436 Introduction to Continuum Biomechanics

Crosslisted with: MECH 836

Prerequisites: Senior or graduate student standing

Notes: MATH 314 and MECH 325 are recommended.

Description: An introduction to continuum biomechanics with an emphasis on soft tissues. Case studies covering diverse applications of biomechanics in biology and medicine, including in the areas of mechanobiology, medical devices, and tissue engineering. Continuum mechanics concepts include kinematics, kinetics, balance laws, and constitutive relations. Includes some programming in MATLAB.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 437 Biomedical Device Design**Crosslisted with:** MECH 837**Prerequisites:** MECH 223, MECH 373**Notes:** basic understanding of solid mechanics**Description:** Design of devices intended for use in biomedical environments. Introduction to modeling of the bio-environment, bio-materials, and material selection. Overview of design methodologies and strategies used in biomedical device design from a material properties perspective. Introduction to federal regulation and other pertinent issues.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** SPRING**MECH 438 Mechanics of Biomaterials****Crosslisted with:** MECH 838**Prerequisites:** MECH 325 or AGEN/BSEN 324 or parallel**Description:** Theory, application, simulation, and design of biomaterials that apply mechanical principles for solving medical problems (case studies in artery, brain, bone, etc.). Tentative Topics include Mechanical characterization of biomaterials; Bio-manufacturing a tissue; Function-structure relationship; Design and analysis of medical implants; Active response of biomaterials: growth and remodeling mechanism; Cellular behavior and measurements, etc.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**MECH 439 Biomaterial Surface Patterning****Crosslisted with:** MECH 839**Description:** Biomaterials, biocompatibility, and biomaterial surface characteristics (chemistry, surface energy, topography, wettability, etc.). Protein adsorption on biomaterials. Microscale and nanoscale chemical patterning; anisotropic and isotropic micro/nanotopography; cell sensing and response to patterned substrates.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 442 Intermediate Kinematics****Crosslisted with:** MECH 842**Prerequisites:** MECH 342.**Description:** Analytical cam design. Geometry of constrained plane motion and application to the design of mechanisms. Analysis and synthesis of pin-jointed linkage mechanisms.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 943**MECH 444 Intermediate Dynamics of Machinery****Crosslisted with:** MECH 844**Prerequisites:** MECH 342 and MECH 350.**Description:** Fundamentals of vibration, vibration and impact in machines, balance of rotors, flexible rotor dynamics and instabilities, parametric vibration, advanced dynamics and design of cam mechanisms, and dynamics of flywheel.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 445 Mechanical Engineering Design Concepts****Crosslisted with:** MECH 845**Prerequisites:** MECH 200, MECH 342, MECH 350, and MECH 310/CIVE 310.**Description:** Development of design concepts. Introduction to synthesis techniques and mathematical analysis methods. Applications of these techniques to mechanical engineering design projects.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 945**Course and Laboratory Fee:** \$20**MECH 446 Mechanical Engineering Design I****Prerequisites:** BSEN 206, MECH 200, MECH 230, MECH 310, MECH 350, professional admission to Mechanical Engineering BS program**Notes:** This course should be taken in the fall semester of the final full academic year, followed immediately by MECH 447 in the spring semester.**Description:** The first of two courses in the capstone sequence. Practical application of the engineering design process in a team project focused on a mechanical engineering problem, including design reviews and reports.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded**Offered:** FALL**Prerequisite for:** MECH 447; MECH 447H**ACE:** ACE 10 Integrated Product**Course and Laboratory Fee:** \$15**Experiential Learning:** Student Teaching/Education Practicum

MECH 446H Honors: Mechanical Engineering Design I

Prerequisites: BSEN 206, MECH 200, MECH 230, MECH 310, MECH 350, professional admission to Mechanical Engineering BS program. Credit toward the degree cannot be earned in both MECH 446 and MECH 446H.

Notes: This course should be taken in the fall semester of the final full academic year, followed immediately by MECH 447H in the spring semester.

Description: The first of two courses in the capstone sequence. Practical application of the engineering design process in a team project focused on a mechanical engineering problem, including design reviews and reports.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

Offered: FALL

Prerequisite for: MECH 447H

ACE: ACE 10 Integrated Product

Experiential Learning: Student Teaching/Education Practicum

MECH 447 Mechanical Engineering Design II

Prerequisites: MECH 446, professional admission to Mechanical Engineering BS program

Description: Definition, scope, analysis, synthesis, and the design for the solution of a comprehensive engineering problem in any major area of mechanical engineering.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

ACE: ACE 10 Integrated Product

Course and Laboratory Fee: \$15

Experiential Learning: Student Teaching/Education Practicum

MECH 447H Honors: Mechanical Engineering Design II

Prerequisites: MECH 446 or MECH 446H, professional admission to Mechanical Engineering BS program. Credit toward the degree cannot be earned in both MECH 447 and MECH 447H.

Description: Definition, scope, analysis, synthesis, and the design for the solution of a comprehensive engineering problem in any major area of mechanical engineering.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

Offered: SPRING

ACE: ACE 10 Integrated Product

Experiential Learning: Student Teaching/Education Practicum

MECH 448 Advanced Mechanics of Materials

Crosslisted with: MECH 848

Prerequisites: MECH 373, MECH 325.

Description: Stresses and strains at a point. Theories of failure. Thick-walled pressure vessels and spinning discs. Torsion of noncircular sections. Torsion of thin-walled sections, open, closed, and multicelled. Bending of unsymmetrical sections. Cross shear and shear center. Curved beams. Introduction to elastic energy methods.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MECH 915; MECH 930; MECH 933; MECH 935; MECH 937; MECH 938; MECH 939; MECH 940; MECH 941; MECH 952

MECH 449 Advanced Dynamics

Crosslisted with: MECH 849

Prerequisites: MECH 373 and MATH 221/821.

Description: Particle Dynamics using Newton's laws, energy principles, momentum principles. Rigid body dynamics using Euler's equations and Lagrange's equations. Variable mass systems. Gyroscopic motion.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MECH 915; MECH 935

MECH 450 Mechanical Engineering Control Systems Design

Crosslisted with: MECH 850

Prerequisites: MECH 350.

Description: Applications of control systems analysis and synthesis for mechanical engineering equipment. Control systems for pneumatic, hydraulic, kinematic, electromechanical, and thermal systems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Course and Laboratory Fee: \$20

MECH 451 Introduction to Finite Element Analysis

Prerequisites: Open to College of Engineering Students only.

Description: Matrix methods of analysis. Finite element stiffness method. Computer programs. Applications to structures and soils. Introduction to finite element analysis of fluid flow.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Course and Laboratory Fee: \$25

MECH 452 Experimental Stress Analysis I

Crosslisted with: MECH 852

Prerequisites: MECH 325.

Description: Investigation of the basic theories and techniques associated with the analysis of stress using mechanical strain gages, electric strain gages, brittle lacquer, photoelasticity, and membrane analogy.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: MECH 952

Course and Laboratory Fee: \$25

MECH 453 Robotics: Kinematics and Design

Crosslisted with: MECH 853

Prerequisites: MECH 350.

Description: Robotics synthesize some aspects of human function by the use of mechanisms, sensors, actuators, and computers.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

MECH 454 Introduction to Continuum Modeling**Crosslisted with:** MECH 854**Prerequisites:** MATH 221/821, MECH 325 and MECH 373**Description:** Basic concepts of continuum modeling. Development of models and solutions to various mechanical, thermal and electrical systems. Thermo-mechanical and electro-mechanical coupling effects. Differential equations, dimensional methods and similarity.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 455 Vehicle Dynamics****Crosslisted with:** MECH 855**Prerequisites:** MECH 343 and MECH 350.**Description:** Introduction to basic mechanics governing automotive vehicle dynamic acceleration, braking, ride, handling and stability. Analytical methods, including computer simulation, in vehicle dynamics. The different components and subsystems of a vehicle that influence vehicle dynamic performance.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Course and Laboratory Fee:** \$20**MECH 456 Dynamics of Internal Combustion Engines****Crosslisted with:** MECH 856**Prerequisites:** MECH 342 and MECH 343.**Description:** Basics of design of the internal combustion engines. Design of various engine parts such as pistons, connecting rods, valve trains, crankshafts, and the vibration dampers. Dynamics of the engine. The vibration of the crankshaft assembly and the valve train. Balancing of the engines.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 457 Mechatronic Systems Design****Crosslisted with:** MECH 857**Prerequisites:** ECEN 231; MECH 350 or parallel.**Notes:** Lab sessions allow for constructing mechatronic systems. Lab time arranged. A comprehensive design project included.**Description:** Theory, application, simulation, and design of systems that integrate mechanical, computer, and electronic components.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 958**MECH 458 Digital Control of Mechanical Systems****Crosslisted with:** MECH 858**Prerequisites:** MECH 450**Description:** Introduction to digital measurement and control of mechanical systems. Applications of analysis and synthesis of discrete time systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Course and Laboratory Fee:** \$20**MECH 470 Theory and Practice of Materials Processing****Crosslisted with:** MECH 870**Prerequisites:** MECH 370**Description:** Theory, practice and application of conventional machining, forming and non-traditional machining processes with emphasis on tool life, dynamics of machine tools and adaptive control.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** MECH 970**MECH 472 Additive Manufacturing****Crosslisted with:** MECH 872**Prerequisites:** MECH 370 or parallel**Description:** In-depth exploration of the physics governing metal additive manufacturing: (1) powder handling and laser-material interaction; (2) melt pool dynamics, defect mechanisms, and microstructure evolution; (3) residual stress development and strategies for post-processing. Emphasis on how these principles affect the quality and properties of additively manufactured metals.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 474 Manufacturing Systems I****Crosslisted with:** MECH 874**Prerequisites:** MECH 370 or equivalent.**Description:** Principles of automated production lines; analysis of transfer lines; group technology; flexible manufacturing systems; and just-in-time; and optimization strategies for discrete parts manufacturing.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**MECH 475 Introduction to Mechanical Vibrations****Crosslisted with:** MECH 875**Prerequisites:** MECH 373 and MATH 221**Description:** Review of rigid body dynamics; equations of motion, free vibration, damping; linear response of one, two, and multi-degree of freedom systems; forced vibrations, harmonic, periodic, impulse, and general responses; resonance and vibration isolation; rotating imbalance; Fourier transforms, digitization and analysis of experimental data.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** MECH 975**Course and Laboratory Fee:** \$25**MECH 476 Manufacturing Information Systems****Crosslisted with:** MECH 876**Prerequisites:** Senior standing; CSCE 155A, CSCE 155E, CSCE 155H, CSCE 155N, or CSCE 155T or equivalent**Description:** An exploration of information systems and their impact in a manufacturing environment. Software, hardware, database systems, enterprise resource planning, networking, and the Internet.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded

MECH 480 Numerical Methods in Engineering

Crosslisted with: MECH 880

Prerequisites: MATH 221/MATH 821; CSCE 155N. Credit toward the degree may be earned in only one of the following: CSCE440/MATH 440 and MECH 480

Notes: MATH 314 recommended.

Description: Numerical algorithms and their convergence properties in: solving nonlinear equations; direct and iterative schemes for linear systems of equations; eigenvalue problems; polynomial and spline interpolation; curve fitting; numerical integration and differentiation; initial and boundary values problems for Ordinary Differential Equations (ODEs) and systems of ODEs with applications to engineering; finite difference methods for partial differential equations (potential problems, heat-equation, wave-equation).

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: CHME 496, CHME 896; MECH 851; MECH 888

Course and Laboratory Fee: \$25

MECH 483 Engineering Analysis with Finite Elements

Crosslisted with: MECH 883

Prerequisites: MECH 310; MECH 343; MECH 350; MECH 420 or parallel

Description: Analysis of engineering systems using finite elements; a critical and challenging task performed during the design process for many engineering systems. Four very distinct domains are studied: Structural stress analysis, heat transfer, fluid flow, and modal analysis.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

MECH 487 Thermal Fluids Laboratory

Prerequisites: MECH 200 and MECH 380; MECH 420/820 or parallel.

Description: Design, execution, and evaluation of physical experiments in the areas of thermodynamics, fluid mechanics, and heat transfer.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

Course and Laboratory Fee: \$30

MECH 488 Kinematics and Machine Design Laboratory

Prerequisites: MECH 342; MECH 380 or parallel.

Description: Design projects and physical experiments in the area of machine design and kinematics.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

Course and Laboratory Fee: \$30

MECH 491 Special Topics in Engineering Mechanics

Crosslisted with: MECH 891

Prerequisites: Permission.

Description: Treatment of special topics in engineering mechanics by experimental, computational and/or theoretical methods. Topics vary from term to term.

Credit Hours: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 6

Grading Option: Graded

Course and Laboratory Fee: \$25

MECH 492 Special Topics

Crosslisted with: MECH 892

Description: Special topics in mechanical engineering and related areas.

Credit Hours: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 24

Grading Option: Graded

MECH 494 Independent Study

Crosslisted with: MECH 894

Prerequisites: Permission

Description: Faculty-supervised independent study.

Credit Hours: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 24

Grading Option: Graded

MECH 498 Research

Crosslisted with: MECH 898

Description: Faculty-supervised research.

Credit Hours: 0-6

Min credits per semester:

Max credits per semester: 6

Max credits per degree: 6

Grading Option: Graded

MECH 499H Honors Thesis

Prerequisites: Senior standing in mechanical engineering; admission to the University Honors Program.

Description: Honors thesis research project meeting the requirements of the University Honors Program. Independent research project executed under the guidance of a member of the faculty of the Department of Mechanical Engineering which contributes to the advancement of knowledge in the field. Culminates in the presentation of an honors thesis to the department and college.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Career Information

The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.

Jobs of Recent Graduates

- Weapon Systems Operation & Sustainment Team, The Boeing Company - Huntsville, AL

- Production Engineer, Kawasaki Motors - Lincoln, NE
- Aerospace Engineer, NASA - Houston, TX
- Power Supply Engineer, Lincoln Electric System - Lincoln, NE
- Operations Management Training Program, Union Pacific - Kansas City, KS
- Airframe Engineer, Textron Aviation - Wichita, KS
- Mechanical Engineer, Schlumberger - Houston, TX
- Design Engineer - Airframe, Cessna Aircraft Company - Wichita, KS
- Field Engineer, Kiewit - Englewood, CO
- Nuclear Officer, United States Navy - Washington, DC
- Engineering Leadership Program - Entry Level Engineer, National Instruments - Austin, TX
- Operations Advanced Development Program, Schneider Electric - Lincoln, NE
- Assistant Mechanical Engineer, Burns and McDonnell - Kansas City, MO
- Infotainment Design Engineer, Honda Research & Development - Columbus, OH
- Research & Development Engineer, Stark Industries - Manhattan, NY
- Consulting Engineer, Black & Veatch - Kansas City, MO
- Project Engineer, Hexagon Lincoln - Lincoln, NE
- Mechanical Engineer, Advanced Aircraft Company - Lincoln, NE
- Machine Design Engineer, Vishay Dale Electronics Inc. - Columbus, NE
- Seating Engineer, Tesla Motors Inc. - Palo Alto, CA
- Design Engineer, Molex Inc. - Lincoln, NE
- Assistant Mechanical Engineer, Burns and McDonnell - Kansas City, MO
- Nuclear Engineer, Omaha Public Power District - Blair, NE
- Product Engineering Development Program, John Deere - Coffeyville, KS
- Mechanical Engineer 1, Honeywell - Kansas City, MO

Internships

- Mechanical Engineering Co-op, NASA - Langley Research Center - Hampton, VA
- Locomotive Intern, BSNF Railway - Fort Worth, TX
- Manufacturing Engineer Intern, John Deere - Springfield, MO
- Mechanical Engineering Co-op, Omaha Public Power District - Omaha, NE
- Propulsion Engineer Intern, Textron Aviation - Wichita, KS
- Mechanical Engineering Intern, HDR - Omaha, NE
- Mechanical Engineering Intern, LI-COR Biosciences - Lincoln, NE
- Mechanical Design Engineer Intern, Valmont Irrigation - Valley, NE
- Mechanical Engineering Intern, Schneider Electric - Lincoln, NE
- Mechanical Engineering Co-op, Nebraska Public Power District - Cooper Nuclear Station - Brownville, NE
- Research Intern, NASA Jet Propulsion Lab - Pasadena, CA
- Mechanical Engineering Co-op, UTC Aerospace - York, NE
- Product Support Technician Intern, Lindsay Manufacturing - Lindsay, NE
- Mechanical Intern, Union Pacific Railroad - De Soto, MO
- Commercialization Analyst Intern, NUtech Ventures - Lincoln, NE
- Research Intern I - Maize Trait Commercialization, DuPont Pioneer - York, NE

- Printing Mechanical Technician Intern, Sandhills Publishing - Lincoln, NE
- Mechanical Engineering Co-op, GE Global Research - Niskayuna, NY
- Robotics Engineering Intern, Lockheed Martin Space Systems - Littleton, CO
- Intern Test Engineer, CNH Industrial - New Holland, PA
- Product Engineering Intern, Molex - Lincoln, NE
- Rotorcraft Aeromechanics LXI, NASA Ames Research Center - Mountain View, CA
- BCA Mechanical/Structural Intern, Boeing - Everett, WA
- Ceramic Research & Development and 3D Printer Maintenance, Tethon 3D - Omaha, NE
- Production Engineering Intern, Kawasaki Motors Manufacturing - Lincoln, NE

Graduate & Professional Schools

- Ph.D., Mechanical Engineering, University of Nebraska-Lincoln - Lincoln, NE
- Ph.D., Aerospace Engineering, University of Michigan - Ann Arbor, MI
- Ph.D., Aeronautics & Astronautics, Stanford University - Stanford, CA
- Ph.D., Biomechanics, University of Nebraska Medical Center - Omaha, NE
- Ph.D., Robotics, Carnegie Mellon University - Pittsburgh, PA
- Master's in Mechanical Engineering, Georgia Institute of Technology - Atlanta, GA
- Master's in Biomedical Engineering, University of Nebraska-Lincoln - Lincoln, NE
- Master's in Mechanical Engineering, University of California-Berkeley - Berkeley, CA
- Ph.D., Aerospace Engineering, University of Texas at Austin - Austin, TX
- Master's in Business Administration, University of Nebraska-Lincoln - Lincoln, NE
- Doctor of Medicine, University of Nebraska Medical Center - Omaha, NE
- Master's in Mechanical Engineering, Texas A&M University - College Station, TX
- Ph.D., Computational Methods, University of Nebraska-Lincoln - Lincoln, NE
- Master's in Mechanical Engineering, University of Utah - Salt Lake City, UT
- Ph.D., Mechanical Engineering, Colorado School of Mines - Golden, CO
- Ph.D., Mechanical Engineering, University of Washington - Seattle, WA
- Ph.D., Material Science and Engineering, University of Illinois - Champaign, IL
- Ph.D., Medical Engineering, University of California - Santa Barbara, CA
- Ph.D., Materials Science and Engineering, Iowa State University - Ames, IA
- Ph.D., Aeronautics and Astronautics, Purdue University - West Lafayette, IN
- Master's in Financial Mathematics, Rutgers University - Piscataway, NJ
- Master's in Mechanical Engineering, University of Illinois Urbana-Champaign - Urbana, IL



- Ph.D., Mechanical Engineering, State University of New York - Binghamton, NY
- Master's in Mechanical Engineering, Stanford University - Stanford, CA
- Master's in Aerospace Engineering, University of Michigan - Ann Arbor, MI