Engineering, Design, and Society

Program Description

The Department of Engineering, Design, and Society (EDS) engages in research, education, and outreach that inspires and empowers engineers and applied scientists to become innovative and impactful leaders. Our specialization is in socio-technical integration, design problem definition and solution, and interdisciplinary, real-world engineering design educational experiences. We seek to educate future leaders who will address the challenges of attaining a thriving, sustainable global society.

EDS is home to:

Bachelor of Science in Design Engineering: Design Engineering is an interdisciplinary engineering degree that focuses on the creation of innovative solutions to the challenging problems facing people, societies, and the world. Through a sequence of Integrated Design Studios that bridge first-year Cornerstone Design and senior-year Capstone Design, students become experts in design methods that deploy engineering principles to address human problems in real-world contexts. Design Engineering provides the flexibility for students to create specialized focus areas that suit their individual career and personal interests, and it ensures they gain practical engineering experience throughout their education at Mines.

Humanitarian Engineering: Mines' Humanitarian Engineering (HE) program is recognized internationally for its research, education, and outreach in socially responsible engineering. At the undergraduate level, HE includes two minors, Engineering for Community Development and Leadership in Social Responsibility, along with a range of electives courses open to all Mines students. At the graduate level, the interdisciplinary Humanitarian Engineering and Science program offers MS thesis and non-thesis degree options as well as a graduate certificate. HE enables Mines students to understand how engineering can contribute to co-creating just and sustainable solutions to the problems faced by communities globally.

Cornerstone Design: Cornerstone Design is a two-course sequence introducing Mines students to the engineering problem solving process. Cornerstone Design I (EDNS151), enrolled by all first-year Mines students, teaches open-ended problem solving, project management, professional communications, and teaming skills—all within a human-centered design framework. Cornerstone Design II (EDNS251 or a similar second-year course), enrolled by approximately half of Mines sophomore engineering students, applies and advances lessons from Cornerstone Design I by responding to real-world engineering challenges.

Capstone Design: Capstone Design entails a culminating two-semester senior design sequence for over half of Mines' engineering students, including those in the Design, Civil, Electrical, Environmental, and Mechanical Engineering programs. Capstone Design proram provides unique client-sponsored, hands-on, interdisciplinary engineering project experiences for participating students.

Programs

Design Engineering

The Bachelor of Science in **Design Engineering** offers an interdisciplinary, creative, and flexible program of study that complements Mines' signature strengths in engineering and applied science. Design Engineering integrates:

1) The inspiration and engagement of studio-based **design education** focusing on technology innovation; open-ended problem solving, and social impact

2) The insights and analytic perspectives of a **broad, liberal arts education**, which helps students focus attention on the right problems and the best overall solutions

3) Mines' signature strength in **engineering applications**, built upon the fundamentals of mathematics, science, and engineering analysis

The Design Engineering curriculum revolves around hands-on, project-based design studios every semester, culminating in Capstone Design. We offer a unique educational experience through our Integrative Design Studios, which bridge the technical, social, and creative potentials of engineering problem solving. Additionally, Design Engineering allows students to specialize in a Focus Area of their choice, enabling students to apply their design expertise and pursue depth of study in an area of personal interest. Focus areas span emerging technologies, the application of technology to underserved communities, and the creation of new technology-driven startups. Design Engineering program details are provided under the Major tab above.

Humanitarian Engineering

Humanitarian Engineering (HE) serves students with a passion for contributing to social and environmental problem solving. HE connects these students to Mines faculty who lead in applying engineering techniques to pressing social, environmental, and community challenges. Integrating engineering with social sciences and design, the HE program spans minors, Design Engineering focus areas, and elective courses where students learn how to work *with* the communities they serve to co-create solutions that promote justice, responsibility, and sustainability. HE serves students from any discipline and with diverse career goals spanning NGOs, government agencies and research groups, start-up businesses, and established companies. Seminar-style courses offered by the Engineering, Design, and Society Department and the Humanities, Arts, and Social Sciences Department, along with selected technical electives offered by other academic units across campus, provide students a balance of breadth and depth in areas related to Humanitarian Engineering. HE program details are provided under the Minor tab above.

Engineering for Community Development

The HE Minor in Engineering for Community Development (ECD) is an evolution of the country's very first minor in Humanitarian Engineering created at Mines in 2003. Designed specifically for engineers and applied scientists who desire to serve communities, the ECD minor prepares students to become leaders in community development through engineering.

Graduates with the ECD minor can work at the US Peace Corps (see Mines Peace Corps Prep Program), community service NGOs, international organizations, or a range of companies hosting projects related to community development. The knowledge and skills learned through the ECD minor prepares graduates for any engineering job involving community engagement, cross-cultural work environments, or human-centered design.

The ECD minor is designed to support any degree program on campus.

Leadership in Social Responsibility

The HE Minor in Leadership in Social Responsibility (LSR) is the country's first undergraduate minor in social responsibility designed specifically for engineers and applied scientists. The LSR minor prepares Mines students to become leaders in promoting shared social, environmental, and economic value for companies and their stakeholders.

Graduates of the LSR minor are sought by corporate employers that desire engineers who are prepared to factor public perception and community acceptance into the decisions they make and the technologies and processes they design. Graduates will also be prepared to take jobs that focus on corporate social responsibility, stakeholder engagement, and sustainability.

The LSR minor is designed to support any degree program on campus.

Humanitarian Engineering and Science (HES) Graduate Programs

The EDS Department also delivers the core curriculum of the inter-departmental Humanitarian Engineering and Science graduate programs. HES program details are in the Mines Catalog under Interdisciplinary Graduate Programs and are also summarized under the Humanitarian Engineering Masters tab above.

Cornerstone Design

Cornerstone Design immerses students in hands-on, open-ended problem-solving through iterative, project-based inquiry. Cornerstone Design combines engineering design, design thinking, and systems analysis to pursue open-ended problem scoping, definition, and articulation—all supported by direct stakeholder engagement and scholarly research. Students learn creative concept generation and selection techniques, solution validation and iteration, prototype development and testing, authoritative information gathering, and engineering analysis. Throughout these design experiences, students learn fundamental STEM analysis, a variety of design tools, and the professional communication skills necessary for academic and professional success.

In Cornerstone Design I (EDNS151), students work in teams on a semester-long design project, learning to communicate technical ideas and solutions visually, orally, in writing, and through prototype demonstrations. Cornerstone Design I introduces students to the human-centered design process, which includes exploration, ideation, solution concept development, and validation, while also ensuring solutions are viable, desirable, feasible, and sustainable.

Cornerstone Design II (EDNS251 and related courses) builds on the foundation of Cornerstone Design I by having student teams manage a client relationship and use commercial design software to model, predict, and analyze solution concepts. Students should check with their degree program to determine whether Cornerstone Design II is stipulated or permissible for satisfying program requirements.

Capstone Design

Capstone Design offers a one-of-a-kind, creative, multidisciplinary, team-based design experience for participating students in Design, Civil, Electrical, Enviornmental, and Mechanical Engineering. Capstone Design embraces the uniqueness of each disciplinary approach while enabling students to address real-world, interdisciplinary challenges. Capstone Design entails a two-semester, senior-year course sequence: Capstone Design I (EDNS491) and Capstone Design II (EDNS492).

Capstone Design addresses ABET accreditation guidelines for the engineering programs, particularly Criterion 3 Student Outcomes 2-5:

- 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.
- An ability to communicate effectively with a range of audiences.
- 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.
- 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.

The **Capstone Design Showcase** celebrates the engineering design achievements of participating students. This campus-wide celebration offers Capstone students an opportunity to present their real-world, client-driven design outcomes completed as part of their Capstone coursework.

Bachelor of Science in Design Engineering

The Bachelor of Science in Design Engineering is a flexible, interdisciplinary program of study combining:

1. The strength of a Mines' technical degree with fundamentals coursework in mathematics, science, and engineering
2. An integrated educational experience spanning engineering, design, innovation, social sciences, and the humanities and
3. A Focus Area allowing for a depth of study in an area of personal or career interest, such as innovation and emerging technologies, sustainability and socially responsible applications of engineering, or an individualized focus area at the intersection of technology and society.

These three components are brought together via:

4. A unique set of six Integrative Design Studios, culminating in the two-semester Capstone Design Studio.

The Integrative Design Studios teach students how to respond to authentic, open-ended problems by integrating diverse skills, perspectives, and disciplinary approaches. They also provide a broad set of design competencies that are applicable to solving problems in any domain. Students work on a wide variety of hands-on projects, individually and in teams, mastering the capacity to move creatively from ill-structured problems to concrete, innovative, human-centered solutions. Through this journey, students also develop a diverse project portfolio, illustrating their unique skills and individual identity as a design engineer.

In parallel with the experiential design approach of the integrative design studios, students have great flexibility in selecting engineering fundamentals and electives courses from a wide variety of engineering disciplines. This flexibility allows students to prepare for their chosen Focus Area or to chart their own engineering, innovation, or design pathways.

The program also includes a design applications experience (EDNS392) for students to develop a critical understanding of how engineers analyze

their design work in the social and technical realms of open-ended problem solving. This opportunity provides motivations for students to explore career options early. It also helps them better understand how their individual design expertise can contribute to a variety of engineering problems, organizational needs, and multidisciplinary teams. Together, the key components of the program promote a "design early, design often, design real" approach to engineering education.

Program Educational Outcomes

The objectives of the Engineering, Design, & Society Bachelor of Science in Design Engineering program are to produce graduates who, within five years of graduation, will:

- Apply their creative interpretation of complex problems and propose novel solution concepts within unique social, technical, ethical and environmental constraints.
- Serve as innovators, bridging the gap between social, technical and creative design disciplinary teams, all while incorporating a high level of ethical standards, social consciousness and technical expertise.
- Seek to contribute to interdisciplinary endeavors and establish positions of leadership through service activities within their profession or community.
- Actively engage in lifelong learning, demonstrating continuous professional growth.

Student Learning Outcomes

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.

Curriculum

The Design Engineering degree program offers students a combination of courses that includes core mathematics, basic and advanced sciences, engineering fundamentals, and foundational studies in the social sciences and humanities throughout the freshman and sophomore years.

There is strong alignment of the initial course sequence between this degree program and other engineering degree programs at Mines, allowing smooth entry into the Bachelor of Science in Design Engineering degree program at any time during the first two years.

In the junior and senior years, students complete fundamental engineering courses across the breadth of traditional engineering disciplines and pursue advanced disciplinary studies through additional engineering electives, emphasizing engineering's breadth as well as commonalities among different engineering disciplines. Integrated with their technical studies, students learn about the many human dimensions of defining and solving problems using perspectives and approaches from the social sciences, humanities, and design, including the creative, social, cultural, political (including policy), economic, and business components critical for understanding the big challenges facing society and the environment today.

A central component of this degree program is the extensive application of technical and non-technical skillsets in response to real-world problems throughout the Integrative Design Studios. This approach increases and solidifies students' understanding of the content from their other courses. The Integrative Design Studio culminates in the Capstone Design Studio sequence, where students draw together the entirety of their educational experience to solve client-sponsored engineering problems in specific areas of student interest.

Bachelor of Science in Design Engineering: Degree Requirements

The curriculum comprises six groups of coursework and experiential learning for a total of 132 credits:

Freshman

Fall		**lec**	**lab**	**sem.hrs**
CSM101	FRESHMAN SUCCESS SEMINAR			1.0
MATH111	CALCULUS FOR SCIENTISTS AND ENGINEERS I			4.0
CHGN121	PRINCIPLES OF CHEMISTRY I			4.0
EDNS200	INTRODUCTION TO DESIGN ENGINEERING			3.0
EDNS191	INTRODUCTION TO INTEGRATIVE DESIGN*			3.0
				15.0

Spring		**lec**	**lab**	**sem.hrs**
MATH112	CALCULUS FOR SCIENTISTS AND ENGINEERS II			4.0
PHGN100	PHYSICS I - MECHANICS			4.0
CSCI128	COMPUTER SCIENCE FOR STEM			3.0
EDNS192	DESIGN AND HUMAN VALUES			3.0
S&W	SUCCESS AND WELLNESS			1.0
				15.0

Sophomore

Fall		**lec**	**lab**	**sem.hrs**
MATH213	CALCULUS FOR SCIENTISTS AND ENGINEERS III			4.0
PHGN200	PHYSICS II-ELECTROMAGNETISM AND OPTICS**			4.0
MATH201	INTRODUCTION TO STATISTICS, CBEN 110, CHGN 122, CHGN 125, CSCI 101, or GEGN 101**#			3.0
EDNS291	DESIGN UNLEASHED			3.0

ELECTIVE	CULTURE AND SOCIETY (CAS) Mid-Level Restricted Elective[##]			3.0
CSM202	INTRODUCTION TO STUDENT WELL-BEING AT MINES			1.0
				18.0

Spring		**lec**	**lab**	**sem.hrs**
MATH225	DIFFERENTIAL EQUATIONS			3.0
CEEN241	STATICS[#]			3.0
MEGN361	THERMODYNAMICS I, CHGN 209, or CBEN 210			3.0
EDNS292	DESIGN FOR A GLOBALIZED WORLD			3.0
ENGR	ENGINEERING ELECTIVE[###]			3.0
				15.0

Junior

Fall		**lec**	**lab**	**sem.hrs**
EBGN321	ENGINEERING ECONOMICS*For the 2023 Catalog EBGN321 replaced EBGN201 as a Core requirement. EBGN321 was added to the core, but has a prerequisite of 60 credit hours. Students whose programs that required EBGN201 the sophomore year may need to wait to take EBGN321 until their junior year. For complete details, please visit: https://www.mines.edu/registrar/core-curriculum/			3.0
MEGN212	INTRODUCTION TO SOLID MECHANICS, CEEN 311, or MTGN 202			3.0
EENG281	INTRODUCTION TO ELECTRICAL CIRCUITS, ELECTRONICS AND POWER or 282[#]			3.0
ENGR	ENGINEERING ELECTIVE[###]			3.0
EDNS391	DESIGN & MODELING OF INTEGRATED SYSTEMS			3.0
FOCUS	FOCUS AREA[####]			3.0
				18.0

Spring		**lec**	**lab**	**sem.hrs**
ENGR	ENGINEERING ELECTIVE[###]			3.0
MEGN351	FLUID MECHANICS, CBEN 307, or CEEN 310			3.0
ENGR	ENGINEERING ELECTIVE[###]			3.0
EDNS392	DESIGN ENGINEERING APPLICATIONS			3.0
FOCUS	FOCUS AREA[####]			3.0
FREE	FREE ELECTIVE			3.0
				18.0

Senior

Fall		**lec**	**lab**	**sem.hrs**
ENGR	ENGINEERING ELECTIVE[###]			3.0
EDNS491	CAPSTONE DESIGN I			3.0
FOCUS	FOCUS AREA[####]			3.0
FOCUS	FOCUS AREA[####]			3.0
ELECTIVE	CULTURE AND SOCIETY (CAS) Mid-Level Restricted Elective[##]			3.0
FREE	FREE ELECTIVE			3.0
				18.0

Spring		**lec**	**lab**	**sem.hrs**
EDNS492	CAPSTONE DESIGN II			3.0
FOCUS	FOCUS AREA[####]			3.0
FOCUS	FOCUS AREA[####]			3.0
ELECTIVE	CULTURE AND SOCIETY (CAS) 400-Level Restricted Elective[##]			3.0
FREE	FREE ELECTIVE			3.0
				15.0

Total Semester Hrs: 132.0

* The EDNS191 and EDNS192 course sequence satisfies parallel Culture and Society (CAS) plus EDNS151 requirements needed for other engineering degrees at Mines. Students may satisfy these requirements by separately taking HASS100 and EDNS151.

** A minimum of 10 credits of Core Distributed Science courses are required. Students must take PHGN200 (PHYSICS II – ELECTROMAGNETISM AND OPTICS) and two of the common distributed science courses: CBEN110, CHGN122 or CHGN125, CSCI101, GEGN101, and MATH201. One of CSCI101 (INTRODUCTION TO COMPUTER SCIENCE) or MATH201 (PROBABILITY AND STATISTICS FOR ENGINEERS) must be taken from this list, and both can be taken depending on student preference.

**# Students have limited flexibility as to when to take two of their Core Distributed Science courses starting in their freshman year into early junior year, and should be decided in consultation with student's advisor to accommodate prerequisite requirements.

*** The EDNS291 and EDNS292 course sequence substitutes for HASS200 GLOBAL STUDIES and any one of the EDNS2XX DESIGN II courses or MEGN200 for this degree only. MEGN200 does not substitute for EDNS2XX DESIGN II credit in any other degree program at this time. Additionally, the EDNS292 sequence does not count toward MEGN200 credit for students transferring out of the DE program into Mechanical Engineering at this time.

ENGINEERING FUNDAMENTALS courses are: (1) one of the **thermodynamics** courses CHGN209, CBEN210, or MEGN361; (2) **statics** CEEN241; (3) one of the **circuits** courses EENG281 or EENG282; (4) one of the **materials** courses MTGN202, CEEN311, or MEGN212; and (5) one of the **fluid mechanics** courses CEEN310, or MEGN351. Prerequisites may apply.

Culture and Society (CAS) Restricted Elective courses, a minimum of 9 credit hours of upper level coursework, as described in the Core Curriculum section of the catalog. Focus Areas may list recommended courses to use for these electives.

ENGINEERING ELECTIVES are purposefully drawn from course offerings provided through other engineering programs. Details are provided in the following section. Some of the Focus Areas identify specific courses from the list of allowed engineering electives that must be taken to satisfy the requirements of the Focus Area. Those engineering elective courses are identified in the Focus Area description as being outside of the 18 credits allocated to Focus Area Coursework.

###Focus Area courses are a coherent set of required and suggested elective offerings around a particular topic. Details are given the Focus Area Requirements section below.

Bachelor of Science in Design Engineering: Engineering Coursework Requirements:

A minimum of 30 credits of Design Engineering Coursework (designated as ENGR in the Bachelor of Science in Design Engineering Degree Requirements listing above) are required (typically ten courses). 15 credits (typically five courses) are prescribed ENGINEERING FUNDAMENTALS courses as noted in footnote # above. The additional 15 credits are ENGINEERING ELECTIVES. The requirement of 30 credits of Engineering Coursework may include engineering courses taken as a part of a student's Focus Areas (Focus Areas may require specific engineering courses be taken – see footnote ### above). This Engineering Coursework requirement combined with specific engineering content in the six INTEGRATIVE DESIGN STUDIOs (allocating 11 credits of the 18 credits for the design studios) and the Capstone Senior Design sequence (EDNS491 and EDNS492) produces 47 credits of engineering course work for this degree program. Note that certain ENGINEERING FUNDAMENTALS may also be prescribed by a Focus Area in order to satisfy prerequisite requirements. Likewise, students are encouraged to select ENGINEERING ELECTIVES to reinforce and complement the courses in the student's chosen Focus Area. ENGINEERING ELECTIVES must be chosen from the list below, or select 400-level courses discussed with and approved by the student's advisor. Finally, note that students must have at least 9 credits at or above the 300-level with a common theme or subject area within the group of courses that make up the required 30 credits of ENGINEERING FUNDAMENTALS and ENGINEERING ELECTIVES to ensure a reasonable level of disciplinary depth in a single field of engineering. Furthermore, students must have at least 9 credits at or above the 400-level of ENGINEERING ELECTIVES plus the 6 credits of capstone senior design course and project work (EDNS491 and EDNS492).

The complexity of integrating various department curriculum, the potential for missing prerequisites, and the need to follow an expected course sequence requires that students develop a 2nd, 3rd and 4th year plan with their advisor during the first semester of their sophomore year course of study, and to collaboratively work with their advisor and Program Director for curricular assessment and approval prior to registration for every semester. The course plan is expected to be a dynamic roadmap for a student's particular degree curriculum.

The following engineering-content courses can be used to satisfy the 15-credit requirement for ENGINEERING ELECTIVES. Please be aware of course prerequisites, reviewed with the student's advisor. The below list includes approved coursework, but is not exhaustive. Students can seek approval from faculty advisor for a course not listed below.

Chemical Engineering

CBEN308	HEAT TRANSFER	3.0
CBEN310	INTRODUCTION TO BIOMEDICAL ENGINEERING	3.0
CBEN312	UNIT OPERATIONS LABORATORY	3.0
CBEN313	UNIT OPERATIONS LABORATORY	3.0
CBEN314	CHEMICAL ENGINEERING HEAT AND MASS TRANSFER	4.0
CBEN315	INTRODUCTION TO ELECTROCHEMICAL ENGINEERING	3.0
CBEN357	CHEMICAL ENGINEERING THERMODYNAMICS	3.0
CBEN358	CHEMICAL ENGINEERING THERMODYNAMICS LABORATORY	1.0
CBEN360	BIOPROCESS ENGINEERING	3.0
CBEN365	INTRODUCTION TO CHEMICAL ENGINEERING PRACTICE	3.0
CBEN372	INTRODUCTION TO BIOENERGY	3.0
CBEN375	CHEMICAL ENGINEERING SEPARATIONS	3.0
CBEN401	PROCESS OPTIMIZATION	3.0
CBEN403	PROCESS DYNAMICS AND CONTROL	3.0
CBEN408	NATURAL GAS PROCESSING	3.0
CBEN409	PETROLEUM PROCESSES	3.0
CBEN415	POLYMER SCIENCE AND TECHNOLOGY	3.0
CBEN416	POLYMER ENGINEERING AND TECHNOLOGY	3.0
CBEN418	KINETICS AND REACTION ENGINEERING	3.0
CBEN420	MATHEMATICAL METHODS IN CHEMICAL ENGINEERING	3.0
CBEN422	CHEMICAL ENGINEERING FLOW ASSURANCE	3.0
CBEN426	ADVANCED FUNCTIONAL POROUS MATERIALS	3.0
CBEN430	TRANSPORT PHENOMENA	3.0
CBEN432	TRANSPORT PHENOMENA IN BIOLOGICAL SYSTEMS	3.0
CBEN435	INTERDISCIPLINARY MICROELECTRONICS	3.0
CBEN440	MOLECULAR PERSPECTIVES IN CHEMICAL ENGINEERING	3.0
CBEN454	APPLIED BIOINFORMATICS	3.0
CBEN460	BIOCHEMICAL PROCESS ENGINEERING	3.0
CBEN461	BIOCHEMICAL PROCESS ENGINEERING LABORATORY	1.0
CBEN469	FUEL CELL SCIENCE AND TECHNOLOGY	3.0
CBEN470	INTRODUCTION TO MICROFLUIDICS	3.0
CBEN472	INTRODUCTION TO ENERGY TECHNOLOGIES	3.0
CBEN480	NATURAL GAS HYDRATES	3.0

Civil & Environmental Engineering

CEEN301	FUNDAMENTALS OF ENVIRONMENTAL ENGINEERING: WATER	3.0
CEEN302	FUNDAMENTALS OF ENVIRONMENTAL ENGINEERING: AIR AND WASTE MANAGEMENT	3.0
CEEN303	ENVIRONMENTAL ENGINEERING LABORATORY	3.0
CEEN312	SOIL MECHANICS	3.0
CEEN312L	SOIL MECHANICS LABORATORY	1.0
CEEN314	STRUCTURAL THEORY	3.0
CEEN315	CIVIL AND ENVIRONMENTAL ENGINEERING TOOLS	1.0
CEEN330	ENGINEERING FIELD SESSION, ENVIRONMENTAL	3.0
CEEN331	ENGINEERING FIELD SESSION, CIVIL	3.0
CEEN350	CIVIL AND CONSTRUCTION ENGINEERING MATERIALS	3.0
CEEN360	INTRODUCTION TO CONSTRUCTION ENGINEERING	3.0

CEEN381	HYDROLOGY AND WATER RESOURCES ENGINEERING	3.0
CEEN401	LIFE CYCLE ASSESSMENT	3.0
CEEN405	NUMERICAL METHODS FOR ENGINEERS	3.0
CEEN406	FINITE ELEMENT METHODS FOR ENGINEERS	3.0
CEEN410	ADVANCED SOIL MECHANICS	3.0
CEEN411	UNSATURATED SOIL MECHANICS	3.0
CEEN415	FOUNDATION ENGINEERING	3.0
CEEN419	RISK ASSESSMENT IN GEOTECHNICAL ENGINEERING	3.0
CEEN421	HIGHWAY AND TRAFFIC ENGINEERING	3.0
CEEN423	SURVEYING FOR ENGINEERS AND INFRASTRUCTURE DESIGN PRACTICES	3.0
CEEN425	CEMENTITIOUS MATERIALS FOR CONSTRUCTION	3.0
CEEN426	DURABILITY OF CONCRETE	3.0
CEEN430	ADVANCED STRUCTURAL ANALYSIS	3.0
CEEN433	MATRIX STRUCTURAL ANALYSIS	3.0
CEEN441	INTRODUCTION TO THE SEISMIC DESIGN OF STRUCTURES	3.0
CEEN442	TIMBER AND MASONRY DESIGN	3.0
CEEN443	DESIGN OF STEEL STRUCTURES	3.0
CEEN445	DESIGN OF REINFORCED CONCRETE STRUCTURES	3.0
CEEN446	STRUCTURAL LOADS	3.0
CEEN460	MOLECULAR MICROBIAL ECOLOGY AND THE ENVIRONMENT	3.0
CEEN461	FUNDAMENTALS OF ECOLOGY	3.0
CEEN470	WATER AND WASTEWATER TREATMENT PROCESSES	3.0
CEEN471	WATER AND WASTEWATER TREATMENT SYSTEMS ANALYSIS AND DESIGN	3.0
CEEN472	ONSITE WATER RECLAMATION AND REUSE	3.0
CEEN473	HYDRAULIC PROBLEMS	3.0
CEEN475	SITE REMEDIATION ENGINEERING	3.0
CEEN477	SUSTAINABLE ENGINEERING DESIGN	3.0
CEEN479	AIR POLLUTION	3.0
CEEN480	CHEMICAL FATE AND TRANSPORT IN THE ENVIRONMENT	3.0
CEEN482	HYDROLOGY AND WATER RESOURCES LABORATORY	3.0
Computer Science		
CSCI303	INTRODUCTION TO DATA SCIENCE	3.0
CSCI306	SOFTWARE ENGINEERING	3.0
CSCI341	COMPUTER ORGANIZATION	3.0
CSCI370	ADVANCED SOFTWARE ENGINEERING	5.0
CSCI400	PRINCIPLES OF PROGRAMMING LANGUAGES	3.0
CSCI403	DATA BASE MANAGEMENT	3.0
CSCI404	ARTIFICIAL INTELLIGENCE	3.0
CSCI410	ELEMENTS OF COMPUTING SYSTEMS	3.0
CSCI422	USER INTERFACES	3.0
CSCI423	COMPUTER SIMULATION	3.0
CSCI425	COMPILER DESIGN	3.0
CSCI436	HUMAN-ROBOT INTERACTION	3.0
CSCI437	INTRODUCTION TO COMPUTER VISION	3.0
CSCI440	PARALLEL COMPUTING FOR SCIENTISTS AND ENGINEERS	3.0
CSCI442	OPERATING SYSTEMS	3.0
CSCI443	ADVANCED PROGRAMMING CONCEPTS USING JAVA	3.0
CSCI448	MOBILE APPLICATION DEVELOPMENT	3.0
CSCI455	GAME THEORY AND NETWORKS	3.0
CSCI470	INTRODUCTION TO MACHINE LEARNING	3.0
CSCI471	COMPUTER NETWORKS I	3.0
CSCI473	ROBOT PROGRAMMING AND PERCEPTION	3.0
CSCI475	INFORMATION SECURITY AND PRIVACY	3.0
CSCI477	ELEMENTS OF GAMES AND GAME DEVELOPMENT	3.0
CSCI478	INTRODUCTION TO BIOINFORMATICS	3.0
Electrical Engineering & Electronics		
EENG307	INTRODUCTION TO FEEDBACK CONTROL SYSTEMS	3.0
EENG310	INFORMATION SYSTEMS SCIENCE I	3.0
EENG311	INFORMATION SYSTEMS SCIENCE II	3.0
EENG350	SYSTEMS EXPLORATION AND ENGINEERING DESIGN LAB	3.0
EENG383	EMBEDDED SYSTEMS	4.0
EENG385	ELECTRONIC DEVICES AND CIRCUITS	4.0
EENG386	FUNDAMENTALS OF ENGINEERING ELECTROMAGNETICS	3.0
EENG389	FUNDAMENTALS OF ELECTRIC MACHINERY	4.0
EENG390	ENERGY, ELECTRICITY, RENEWABLE ENERGY, AND ELECTRIC POWER GRID	3.0
EENG411	DIGITAL SIGNAL PROCESSING	3.0
EENG413	ANALOG AND DIGITAL COMMUNICATION SYSTEMS	4.0
EENG415	DATA SCIENCE FOR ELECTRICAL ENGINEERING	3.0
EENG417	MODERN CONTROL DESIGN	3.0
EENG423	INTRODUCTION TO VLSI DESIGN	3.0
EENG425	INTRODUCTION TO ANTENNAS	3.0
EENG427	WIRELESS COMMUNICATIONS	3.0
EENG428	COMPUTATIONAL ELECTROMAGNETICS	3.0
EENG429	ACTIVE RF & MICROWAVE DEVICES	3.0
EENG430	PASSIVE RF & MICROWAVE DEVICES	3.0
EENG437	INTRODUCTION TO COMPUTER VISION	3.0
EENG470	INTRODUCTION TO HIGH POWER ELECTRONICS	3.0
EENG475	INTERCONNECTION OF RENEWABLE ENERGY, INTEGRATED POWER ELECTRONICS, POWER SYSTEMS, AND POWER QUALITY	3.0
EENG480	POWER SYSTEMS ANALYSIS	3.0
EENG481	ANALYSIS AND DESIGN OF ADVANCED ENERGY SYSTEMS	3.0
EENG486	ELECTROMAGNETIC FIELDS AND WAVES	3.0
EENG489	COMPUTATIONAL METHODS IN ENERGY SYSTEMS AND POWER ELECTRONICS	3.0

PHGN317	SEMICONDUCTOR CIRCUITS- DIGITAL	3.0
Geological Engineering		
GEGN307	PETROLOGY	4.0
GEGN316	FIELD GEOLOGY	6.0
GEGN342	ENGINEERING GEOMORPHOLOGY	3.0
GEGN466	GROUNDWATER ENGINEERING	3.0
GEGN468	ENGINEERING GEOLOGY AND GEOTECHNICS	4.0
GEGN469	ENGINEERING GEOLOGY DESIGN	3.0
GEGN470	GROUND-WATER ENGINEERING DESIGN	3.0
GEGN475	APPLICATIONS OF GEOGRAPHIC INFORMATION SYSTEMS	3.0
GEGN483	MATHEMATICAL MODELING OF GROUNDWATER SYSTEMS	3.0
Geology		
GEOL308	INTRODUCTORY APPLIED STRUCTURAL GEOLOGY	3.0
GEOL310	EARTH MATERIALS	3.0
GEOL311	MINING GEOLOGY	3.0
GEOL315	SEDIMENTOLOGY AND STRATIGRAPHY	3.0
GEOL321	MINERALOGY AND MINERAL CHARACTERIZATION	3.0
GEOL470	APPLICATIONS OF SATELLITE REMOTE SENSING	3.0
Mechanical Engineering		
MEGN315	DYNAMICS	3.0
MEGN324	INTRODUCTION TO FINITE ELEMENT ANALYSIS	3.0
MEGN381	MANUFACTURING PROCESSES	3.0
MEGN391	INTRODUCTION TO AUTOMOTIVE DESIGN	3.0
MEGN412	ADVANCED MECHANICS OF MATERIALS	3.0
MEGN414	MECHANICS OF COMPOSITE MATERIALS	3.0
MEGN416	ENGINEERING VIBRATION	3.0
MEGN417	VEHICLE DYNAMICS & POWERTRAIN SYSTEMS	3.0
MEGN430	MUSCULOSKELETAL BIOMECHANICS	3.0
MEGN435	MODELING AND SIMULATION OF HUMAN MOVEMENT	3.0
MEGN436	COMPUTATIONAL BIOMECHANICS	3.0
MEGN441	INTRODUCTION TO ROBOTICS	3.0
MEGN451	AERODYNAMICS	3.0
MEGN461	THERMODYNAMICS II	3.0
MEGN466	INTRODUCTION TO INTERNAL COMBUSTION ENGINES	3.0
MEGN467	PRINCIPLES OF BUILDING SCIENCE	3.0
MEGN469	FUEL CELL SCIENCE AND TECHNOLOGY	3.0
MEGN471	HEAT TRANSFER	3.0
MEGN481	MACHINE DESIGN	3.0
Metallurgical and Materials Engineering		
MTGN334	CHEMICAL PROCESSING OF MATERIALS	3.0
MTGN314	PROPERTIES AND PROCESSING OF CERAMICS	2.0
MTGN314L	PROPERTIES AND PROCESSING OF CERAMICS LABORATORY	1.0
MTGN315	ELECTRICAL PROPERTIES AND APPLICATIONS OF MATERIALS	3.0
MTGN334L	CHEMICAL PROCESSING OF MATERIALS LABORATORY	1.0
MTGN348	MICROSTRUCTURAL DEVELOPMENT	3.0
MTGN348L	MICROSTRUCTURAL DEVELOPMENT LABORATORY	1.0
MTGN350	STATISTICAL PROCESS CONTROL AND DESIGN OF EXPERIMENTS	3.0
MTGN352	METALLURGICAL AND MATERIALS KINETICS	3.0
MTGN414	ADVANCED PROCESSING AND SINTERING OF CERAMICS	3.0
MTGN419	NON-CRYSTALLINE MATERIALS	3.0
MTGN429	METALLURGICAL ENVIRONMENT	3.0
MTGN430	PHYSICAL CHEMISTRY OF IRON AND STEELMAKING	3.0
MTGN431	HYDRO- AND ELECTRO-METALLURGY	3.0
MTGN442	ENGINEERING ALLOYS	3.0
MTGN445	MECHANICAL PROPERTIES OF MATERIALS	3.0
MTGN445L	MECHANICAL PROPERTIES OF MATERIALS LABORATORY	1.0
MTGN451	CORROSION ENGINEERING	3.0
MTGN456	ELECTRON MICROSCOPY	2.0
MTGN456L	ELECTRON MICROSCOPY LABORATORY	1.0
MTGN461	TRANSPORT PHENOMENA AND REACTOR DESIGN FOR METALLURGICAL AND MATERIALS ENGINEERS	3.0
MTGN465	MECHANICAL PROPERTIES OF CERAMICS	3.0
MTGN467	MATERIALS DESIGN: SYNTHESIS, CHARACTERIZATION AND SELECTION	2.0
MTGN468	MATERIALS DESIGN: SYNTHESIS, CHARACTERIZATION AND SELECTION	2.0
MTGN469	FUEL CELL SCIENCE AND TECHNOLOGY	3.0
MTGN472	BIOMATERIALS I	3.0
MTGN473	COMPUTATIONAL MATERIALS	3.0
MTGN475	METALLURGY OF WELDING	2.0
MTGN475L	METALLURGY OF WELDING LABORATORY	1.0
Mining		
MNGN310	EARTH MATERIALS	3.0
MNGN311	MINING GEOLOGY	3.0
MNGN312	SURFACE MINE DESIGN	3.0
MNGN314	UNDERGROUND MINE DESIGN	3.0
MNGN316	COAL MINING METHODS	3.0
MNGN317	DYNAMICS FOR MINING ENGINEERS	1.0
MNGN321	INTRODUCTION TO ROCK MECHANICS	3.0
MNGN333	EXPLOSIVES ENGINEERING I	3.0
MNGN350	INTRODUCTION TO GEOTHERMAL ENERGY	3.0
MNGN406	DESIGN AND SUPPORT OF UNDERGROUND EXCAVATIONS	3.0
MNGN408	UNDERGROUND DESIGN AND CONSTRUCTION	2.0
MNGN414	MINE PLANT DESIGN	3.0
MNGN418	ADVANCED ROCK MECHANICS	3.0
MNGN422	FLOTATION	2.0

MNGN424	MINE VENTILATION	3.0
MNGN431	MINING AND METALLURGICAL ENVIRONMENT	3.0
MNGN433	MINE SYSTEMS ANALYSIS I	3.0
MNGN436	UNDERGROUND COAL MINE DESIGN	3.0
MNGN461	TRANSPORT PHENOMENA AND REACTOR DESIGN FOR METALLURGICAL AND MATERIALS ENGINEERS	3.0
Petroleum Engineering		
PEGN305	COMPUTATIONAL METHODS IN PETROLEUM ENGINEERING	2.0
PEGN308	RESERVOIR ROCK PROPERTIES	3.0
PEGN311	DRILLING ENGINEERING	3.0
PEGN312	PROPERTIES OF PETROLEUM ENGINEERING FLUIDS	3.0
PEGN411	MECHANICS OF PETROLEUM PRODUCTION	3.0
PEGN414	WELL TESTING AND ANALYSIS	3.0
PEGN419	WELL LOG ANALYSIS AND FORMATION EVALUATION	3.0
PEGN423	PETROLEUM RESERVOIR ENGINEERING I	3.0
PEGN424	PETROLEUM RESERVOIR ENGINEERING II	3.0
PEGN426	FORMATION DAMAGE AND STIMULATION	3.0
PEGN438	PETROLEUM DATA ANALYTICS	3.0
PEGN460	FLOW IN PIPE NETWORKS	3.0
PEGN461	SURFACE FACILITIES DESIGN AND OPERATION	3.0
PEGN490	RESERVOIR GEOMECHANICS	3.0

Bachelor of Science in Design Engineering: Focus Areas

Focus Areas are a compilation of prescribed and suggested courses and topical projects that have been reviewed by a broad spectrum of faculty from multiple programs/departments and of varied professional background who assess the collection of content to encompass *technical, innovation, design, social/cultural, and environmental* pillars needed by students who plan to pursue a career in that focus area.

All Focus Areas require a minimum of 18 credits of course work which may include prescribed or recommended engineering courses. In addition to the directed Focus Area coursework, certain HASS and engineering electives may be suggested as supporting the Focus Area. Students should work closely with their advisor to select their electives in a way that complements their Focus Area studies.

In addition to coursework specific to their Focus Area, students must also complete a 6-credit, two-semester capstone senior design project. This project is the culmination of the student's studies and brings together content learned through the three previous years of Integrative Design Studios, science, mathematics, engineering coursework, and Focus Area coursework.

A limited number of Focus Areas are currently defined. New Focus Areas will be added periodically, depending on student and faculty interest, as described in a separate Design Engineering Program Management document.

Current Focus Areas:

- **Energy Studies** (global energy development, sustainable energy, energy policy)
- **Robotics and Automation**
- **Water Security** (water quality, storage and management, efficient utilization, policy, law)
- **Music, Audio Engineering, and Recording Arts**
- **Corporate Sustainability**
- **Community Development**
- **STEM Teaching**
- **Individualized** (customized course of study)

Focus Area Requirements:

Focus Area – Energy Studies:

Students must take the following courses:

ENGY200	INTRODUCTION TO ENERGY	3.0
ENGY340	NUCLEAR ENERGY	3.0
ENGY350	GEOTHERMAL ENERGY	3.0
PHGN419	PRINCIPLES OF SOLAR ENERGY SYSTEMS	3.0
PEGN450	ENERGY ENGINEERING *	3.0

* PEGN450 is also listed in the ENGINEERING ELECTIVE list of courses. Students may not count PEGN450 as an ENGINEERING ELECTIVE credit.

Students must also select one of the following courses:

EBGN330	ENERGY ECONOMICS	3.0
HASS486	SCIENCE AND TECHNOLOGY POLICY **	3.0
HASS490	ENERGY AND SOCIETY **	3.0

** HASS486 and HASS490, if used for Focus Area credits, may not also count toward the 9 credits of required Culture and Society (CAS) Restricted Electives.

Focus Area – Robotics and Automation:

NOTE: *To satisfy pre-reqs* - For their ENGINEERING ELECTIVES courses in students must select CSCI261 (Programming), CSCI262 (Data Structures), EENG284 (Digital).

Students must take the following courses:

MEGN315	DYNAMICS *	3.0
EENG307	INTRODUCTION TO FEEDBACK CONTROL SYSTEMS *	3.0
EENG383	EMBEDDED SYSTEMS *	4.0
MEGN441	INTRODUCTION TO ROBOTICS	3.0

* MEGN315, EENG307, and EENG383 are also listed in the ENGINEERING ELECTIVE list of courses. Students may not count these three courses as ENGINEERING ELECTIVE credits.

Students must also select two of the following courses:

CSCI404	ARTIFICIAL INTELLIGENCE	3.0
CSCI432	ROBOT ETHICS	3.0
CSCI436	HUMAN-ROBOT INTERACTION	3.0
CSCI437	INTRODUCTION TO COMPUTER VISION	3.0

CSCI470	INTRODUCTION TO MACHINE LEARNING	3.0
MEGN481	MACHINE DESIGN	3.0

Focus Area – Water Security:

NOTE: *To satisfy pre-reqs* - For their ENGINEERING FUNDAMENTALS courses in students must select CHGN209 (Thermo), CEEN310 (Fluids) and CEEN311 (Materials).

Students must take the following courses:

CEEN301	FUNDAMENTALS OF ENVIRONMENTAL ENGINEERING: WATER *	3.0
CEEN381	HYDROLOGY AND WATER RESOURCES ENGINEERING *	3.0
CHGN403	INTRODUCTION TO ENVIRONMENTAL CHEMISTRY	3.0
CEEN470	WATER AND WASTEWATER TREATMENT PROCESSES	3.0
CEEN480	CHEMICAL FATE AND TRANSPORT IN THE ENVIRONMENT	3.0

* CEEN301 and CEEN381 are also listed in the ENGINEERING ELECTIVE list of courses. Students may not also count these courses as ENGINEERING ELECTIVE courses.

Students must also select one of the following courses:

EBGN310	ENVIRONMENTAL AND RESOURCE ECONOMICS	3.0
HASS488	GLOBAL WATER POLITICS AND POLICY **	3.0

** HASS488, if used for Focus Area credits, may not also count toward the 9 credits of Culture and Society (CAS) Restricted Electives.

Focus Area – Music, Audio Engineering, and Recording Arts:

NOTE: *To satisfy pre-reqs* - For their ENGINEERING ELECTIVES courses in students must select EENG307 (Feedback Control) and MEGN315 (Dynamics).

Students must take the following courses**:

HASS324	AUDIO/ACOUSTICAL ENGINEERING AND SCIENCE **	3.0
HASS326	MUSIC THEORY **	3.0
HASS327	MUSIC TECHNOLOGY **	3.0
HASS429	REAL WORLD RECORDING/RESEARCH **	3.0
EENG385	ELECTRONIC DEVICES AND CIRCUITS	4.0
MEGN416	ENGINEERING VIBRATION	3.0

** HASS324, HASS326, HASS327, and HASS429 may not also count toward the required 9 credits of Culture and Society (CAS) Restricted Electives.

It is also suggested that students participate in **Performance Enhancement** (3 credits total taken as Free Elective):

LIMU	ENSEMBLE	
LIMU189	INDIVIDUAL INSTRUMENTAL OR VOCAL MUSIC INSTRUCTION	1.0

Focus Area – Community Development:

NOTE: *To satisfy pre-reqs* - For their ENGINEERING ELECTIVES courses in students must select CEEN301 (Fund. of EnvE: Water).

Students must take the following courses:

EDNS315	ENGINEERING FOR SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	3.0
EDNS477	ENGINEERING AND SUSTAINABLE COMMUNITY DEVELOPMENT *	3.0
EDNS478	ENGINEERING AND SOCIAL JUSTICE *	3.0
EDNS479	COMMUNITY-BASED RESEARCH *	3.0

* EDNS477, EDNS478, and EDNS479 may not also count toward the 9 credits of Culture and Society (CAS) Restricted Electives.

Students must also select TWO of the following courses:

	ANY 400+ HNRS COURSE	
CEEN401	LIFE CYCLE ASSESSMENT	3.0
CEEN472	ONSITE WATER RECLAMATION AND REUSE	3.0
CEEN475	SITE REMEDIATION ENGINEERING	3.0
CEEN477	SUSTAINABLE ENGINEERING DESIGN	3.0
CEEN479	AIR POLLUTION	3.0
CEEN556	MINING AND THE ENVIRONMENT	3.0
EBGN340	ENERGY AND ENVIRONMENTAL POLICY	3.0
EDNS401	PROJECTS FOR PEOPLE	3.0
HASS419	ENVIRONMENTAL COMMUNICATION	3.0
HASS425	INTERCULTURAL COMMUNICATION **	3.0
HASS427	RISK COMMUNICATION	3.0
HASS468	ENVIRONMENTAL JUSTICE	3.0
HASS490	ENERGY AND SOCIETY	3.0
MNGN470	SAFETY AND HEALTH MANAGEMENT IN THE MINING INDUSTRY	3.0
PEGN430	ENVIRONMENTAL LAW AND SUSTAINABILITY	3.0

** HASS425 if used for Focus Area credits, may not also count toward the 9 credits of Culture and Society (CAS) Restricted Electives.

Focus Area – Corporate Sustainability:

NOTE: *To satisfy pre-reqs* - For their ENGINEERING ELECTIVES courses in students must select CEEN301 (Fund. of EnvE: Water).

Students must take the following courses:

EDNS315	ENGINEERING FOR SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	3.0
EDNS430	CORPORATE SOCIAL RESPONSIBILITY **	3.0
EDNS478	ENGINEERING AND SOCIAL JUSTICE	3.0
EDNS479	COMMUNITY-BASED RESEARCH **	3.0

** EDNS430 and EDNS479 may not also count toward the 9 credits of Culture and Society (CAS) Restricted Electives.

Students must also select TWO of the following courses:

	ANY 400+ HNRS COURSE	
CEEN401	LIFE CYCLE ASSESSMENT	3.0
CEEN472	ONSITE WATER RECLAMATION AND REUSE	3.0
CEEN475	SITE REMEDIATION ENGINEERING	3.0
CEEN477	SUSTAINABLE ENGINEERING DESIGN	3.0
CEEN479	AIR POLLUTION	3.0
CEEN556	MINING AND THE ENVIRONMENT	3.0
EBGN340	ENERGY AND ENVIRONMENTAL POLICY	3.0
EDNS401	PROJECTS FOR PEOPLE	3.0
HASS419	ENVIRONMENTAL COMMUNICATION	3.0
HASS425	INTERCULTURAL COMMUNICATION	3.0
HASS427	RISK COMMUNICATION	3.0
HASS468	ENVIRONMENTAL JUSTICE	3.0
HASS490	ENERGY AND SOCIETY	3.0
MNGN470	SAFETY AND HEALTH MANAGEMENT IN THE MINING INDUSTRY	3.0
PEGN430	ENVIRONMENTAL LAW AND SUSTAINABILITY	3.0

Focus Area - STEM Teaching:

Students must take the following courses:

SCED262	K-12 FIELD EXPERIENCE AND BUILDING STUDENT RELATIONSHIPS	3.0
SCED333	EDUCATIONAL PSYCHOLOGY AND ASSESSMENT *	3.0
SCED363	DYNAMIC TEACHING: MOTIVATION, CLASSROOM MANAGEMENT, AND DIFFERENTIATION OF INSTRUCTION *	3.0
SCED464	CAPSTONE CURRICULUM DESIGN I	3.0

* SCED333 and SCED363 may not double-count for both the Focus Area and the Culture and Society (CAS) Restricted Electives

Students must also select one of the following courses:

MAED405	MATHEMATICAL PRACTICES AND THE SOCIAL CONTEXT OF MATHEMATICS	3.0
SCED415	SCIENTIFIC PRACTICES VS ENGINEERING DESIGN AND THE NATURE OF SCIENCE	3.0

Students must also select one of the following courses:

MAED425	PRE-ALGEBRA AND ALGEBRA TEACHING TECHNIQUES	3.0
SCED445	PHYSICS AND CHEMISTRY TEACHING TECHNIQUES	3.0

Focus Area – Individualized Focus Areas:

An Individualized Focus Area (IFA) is a customized course of study along with an associated senior design capstone experience that is agreed upon by the student, advisor, and Design Engineering Program Director. Typically, an IFA is defined for a student whose interests and passions are not represented by the existing predefined Focus Areas. The advisor and Design Engineering Program Director are responsible for ensuring an IFA meets the same standards as any of the predefined Focus Areas in the Design Engineering program, as described below in the Program Management section, including having at least three faculty mentors. The transcripts of students who follow an IFA will be denoted as “Individualized Focus Area” without further reference to the focus topic.

Major GPA

The Undergraduate Council considered the policy concerning required major GPAs and which courses are included in each degree’s GPA. While the GPA policy has not been officially updated, in order to provide transparency, council members agreed that publishing the courses included in each degree’s GPA is beneficial to students.

The following list details the courses that are included in the GPA for this degree:

- EDNS100 through EDNS599

The Mines guidelines for Minor/ASI can be found in the Undergraduate Information section of the Mines Catalog.

Minor in Engineering for Community Development

Program requirements (18 credits)

Introductory Courses (9 credits required):		
EDNS315	ENGINEERING FOR SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	3.0
EDNS478	ENGINEERING AND SOCIAL JUSTICE	3.0
EDNS479	COMMUNITY-BASED RESEARCH	3.0
ECD Required Course (3 credits required):		
EDNS477	ENGINEERING AND SUSTAINABLE COMMUNITY DEVELOPMENT	3.0
CAS Elective (3 credits from this list):		
ANY 400+ HNRS COURSE		
HASS419	ENVIRONMENTAL COMMUNICATION	3.0
HASS425	INTERCULTURAL COMMUNICATION	3.0
HASS427	RISK COMMUNICATION	3.0
HASS468	ENVIRONMENTAL JUSTICE	3.0
HASS490	ENERGY AND SOCIETY	3.0
OR AN CAS COURSE APPROVED BY MINOR DIRECTOR AS APPROPRIATE		
Elective (3 credits from this list):		
EDNS401	PROJECTS FOR PEOPLE	3.0
PEGN430	ENVIRONMENTAL LAW AND SUSTAINABILITY	3.0
CEEN401	LIFE CYCLE ASSESSMENT	3.0
CEEN472	ONSITE WATER RECLAMATION AND REUSE	3.0
CEEN477	SUSTAINABLE ENGINEERING DESIGN	3.0
CEEN479	AIR POLLUTION	3.0
CEEN475	SITE REMEDIATION ENGINEERING	3.0
CEEN556	MINING AND THE ENVIRONMENT	3.0
MNGN470	SAFETY AND HEALTH MANAGEMENT IN THE MINING INDUSTRY	3.0

EBGN340	ENERGY AND ENVIRONMENTAL POLICY	3.0
OR A COURSE APPROVED BY MINOR DIRECTOR AS APPROPRIATE		

Minor in Leadership in Social Responsibility

The Minor in Leadership in Social Responsibility will prepare CSM students to become leaders in identifying and promoting the role that engineers can play in advancing social responsibility inside corporations. Graduates will be able to articulate the strategic value of social responsibility for business, particularly in achieving and maintaining the social license to operate, and the role engineering itself can play in advancing a firm's social responsibility program, including community engagement.

For CSM students to "solve the world's challenges related to the earth, energy and the environment," they must also be able to navigate the increasingly complex social, political, and economic contexts that shape those challenges. Achieving the social license to operate, for example, is recognized as necessary for developing mineral resources in the US and abroad. Stewardship of the earth, development of materials, overcoming the earth's energy challenges, and fostering environmentally sound and sustainable solutions – the bedrock of the Mines vision articulated in the Strategic Plan – requires engineers and applied scientists who are able to work in local and global contexts that are shaped by the sometimes conflicting demands of stakeholders, governments, communities and corporations. Reasoning through and managing these competing demands is at the core of social responsibility.

Minor in Leadership in Social Responsibility (18 credits required)

Introductory Courses (9 credits required):		
EDNS315	ENGINEERING FOR SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	3.0
EDNS478	ENGINEERING AND SOCIAL JUSTICE	3.0
EDNS479	COMMUNITY-BASED RESEARCH	3.0
LSR Required Course (3 credits required):		
EDNS430	CORPORATE SOCIAL RESPONSIBILITY	3.0
CAS Elective (3 credits from this list):		
ANY 400+ HNRS COURSE		
HASS419	ENVIRONMENTAL COMMUNICATION	3.0
HASS425	INTERCULTURAL COMMUNICATION	3.0
HASS427	RISK COMMUNICATION	3.0
HASS468	ENVIRONMENTAL JUSTICE	3.0
HASS490	ENERGY AND SOCIETY	3.0
OR AN CAS COURSE APPROVED BY MINOR DIRECTOR AS APPROPRIATE		
Elective (3 credits from this list):		
CEEN401	LIFE CYCLE ASSESSMENT	3.0
CEEN472	ONSITE WATER RECLAMATION AND REUSE	3.0
CEEN475	SITE REMEDIATION ENGINEERING	3.0
CEEN477	SUSTAINABLE ENGINEERING DESIGN	3.0
CEEN479	AIR POLLUTION	3.0
CEEN556	MINING AND THE ENVIRONMENT	3.0
EBGN340	ENERGY AND ENVIRONMENTAL POLICY	3.0
EDNS401	PROJECTS FOR PEOPLE	3.0
MNGN470	SAFETY AND HEALTH MANAGEMENT IN THE MINING INDUSTRY	3.0
PEGN430	ENVIRONMENTAL LAW AND SUSTAINABILITY	3.0
OR A COURSE APPROVED BY MINOR DIRECTOR AS APPROPRIATE		

Area of Special Interest in Humanitarian Engineering (12 credits)

Intro Course		**3.0**
EDNS315	ENGINEERING FOR SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	
Select one of the following:		**3.0**
EDNS301	HUMAN-CENTERED PROBLEM DEFINITION	
EDNS401	PROJECTS FOR PEOPLE	
EDNS430	CORPORATE SOCIAL RESPONSIBILITY	
Select two of the following:		**6.0**
EDNS325	CULTURAL ANTHROPOLOGY	
EDNS475	ENGINEERING CULTURES IN THE DEVELOPING WORLD	
EDNS477	ENGINEERING AND SUSTAINABLE COMMUNITY DEVELOPMENT	
EDNS478	ENGINEERING AND SOCIAL JUSTICE	
EDNS479	COMMUNITY-BASED RESEARCH	
EDNS480	ANTHROPOLOGY OF DEVELOPMENT	
HASS425	INTERCULTURAL COMMUNICATION	
CEEN477	SUSTAINABLE ENGINEERING DESIGN	

Courses

EDNS151. CORNERSTONE - DESIGN I. 3.0 Semester Hrs.
Equivalent with EPIC151,
(I, II, S) Design I teaches students how to solve open-ended problems in a hands-on manner using critical thinking and workplace skills. Students work in multidisciplinary teams to learn through doing, with emphasis on defining and diagnosing the problem through a holistic lens of technology, people and culture. Students follow a user-centered design methodology throughout the process, seeking to understand a problem from multiple perspectives before attempting to solve it. Students learn and apply specific skills throughout the semester, including: communication (written, oral, graphical), project management, concept visualization, critical thinking, effective teamwork, as well as building and iterating solutions.

EDNS155. CORNERSTONE DESIGN I: GRAPHICS. 1.0 Semester Hr.
Equivalent with EPIC155,
(I ,II, S) Design I: Graphics teaches students conceptualization and visualization skills, and how to represent ideas graphically, both by hand and using computer aided design (CAD).

EDNS156. AUTOCAD BASICS. 1.0 Semester Hr.
(I, II) This course explores the two- and three-dimensional viewing and construction capabilities of AutoCAD. Students will learn to use AutoCAD for modeling (2D line drawing, 3D construction, Rendering, Part Assembly) and will develop techniques to improve speed and accuracy. The AutoCAD certification exam will not be offered as part of this course; however, the professor will provide instructions on accessing certification options, which generally have their own fees associated with them. 3 hours lab; 1 semester hour.

EDNS157. SOLIDWORKS BASICS (FOR CERTIFICATION). 1.0 Semester Hr.
(I, II) Students will become familiar and confident with Solidworks CAD program and be able to use most of the basic functions well, including Parts, Assemblies, and Drawing Layouts. The Associate-level certification exam will be offered at the end of the course, and while there are no guarantees for students becoming certified, students will have gained the necessary skills to try. 3 hours lab; 1 semester hour.

EDNS191. INTRODUCTION TO INTEGRATIVE DESIGN. 3.0 Semester Hrs.
Students are introduced to human-centered design methodologies relative to open-ended problem solving using socially relevant challenges. Students in this first design studio course utilize a range of resources to explore ethical implications and test the logic of arguments for/against proposed design solutions. Hands-on activities and graphical visualization are utilized to approach the design process in a collaborative team environment. Students begin compiling a personal design portfolio that carries through their undergraduate studies for the Bachelor of Science in Design Engineering degree.

EDNS192. DESIGN AND HUMAN VALUES. 4.0 Semester Hrs.
Students explore and participate in design activities as an individual or on smaller teams. Projects include the design of experiential activities or community projects. Students evaluate the history of science and engineering and its impact on social and political systems as a foundation for creating smarter designs. Prototyping skills are utilized to explore design functionality and potential alternatives. The course emphasizes technical writing along with the development of other communication formats. Prerequisite: EDNS191 or EDNS151.

EDNS198. SPECIAL TOPCS. 1-6 Semester Hr.
(I, II) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once. Variable credit; 1 to 6 credit hours. Repeatable for credit under different titles.

EDNS199. INDEPENDENT STUDY. 1-6 Semester Hr.
(I, II) Individual research or special problem projects supervised by a faculty member, also, when a student and instructor agree on a subject matter, content, and credit hours. Prerequisite: Independent Study form must be completed and submitted to the Registrar. Variable credit; 1 to 6 credit hours. Repeatable for credit.

EDNS199. INDEPENDENT STUDY. 1-6 Semester Hr.
(I, II) Individual research or special problem projects supervised by a faculty member, also, when a student and instructor agree on a subject matter, content, and credit hours. Prerequisite: Independent Study form must be completed and submitted to the Registrar. Variable credit; 1 to 6 credit hours. Repeatable for credit.

EDNS200. INTRODUCTION TO DESIGN ENGINEERING. 3.0 Semester Hrs.
(I, II) Students are introduced to the unique ways designers frame complex open-ended problems, engage with end users, and develop solutions to meet the needs of diverse stakeholders. Students are introduced to designers? creative communication strategies, including basic techniques for written, oral, graphic, and tangible product communication. Students will engage in individual and team-based projects, honing their design identity as well as their unique contributions to collaborative challenges. With extensive opportunity for design feedback and iteration, students learn to produce and analyze design artifacts for varied audiences and contexts. 5 studio hours; 3 semester hours. Prerequisite: none Co-requisite: none.

EDNS205. PROGRAMMING CONCEPTS AND ENGINEERING ANALYSIS. 3.0 Semester Hrs.
(I,II) This course provides an introduction to techniques of scientific computation that are utilized for engineering analysis, with the software package MATLAB as the primary computational platform. The course focuses on methods data analysis and programming, along with numerical solutions to algebraic and differential equations. Engineering applications are used as examples throughout the course. 3 hours lecture; 3 semester hours.

EDNS251. CORNERSTONE DESIGN II. 3.0 Semester Hrs.
Equivalent with EPIC251,
(I, II, S) Design II builds on the design process introduced in Design I, which focuses on open-ended problem solving in which students integrate teamwork and communications with the use of computer software as tools to solve engineering problems. Computer applications emphasize information acquisition and processing based on knowing what new information is necessary to solve a problem and where to find the information efficiently. Teams analyze team dynamics through weekly team meetings and progress reports. The course emphasizes oral presentations and builds on written communications techniques introduced in Design I. 2 hours lecture, 3 hours lab; 3 semester hours. Prerequisite: EDNS151, EDNS155, EDNS192, or HNRS115.

EDNS261. DESIGN II: GIS. 3.0 Semester Hrs.
Equivalent with EPIC261,
(I,II,S) The Design II: GIS builds on the design process learned in Design I, which focuses on open-ended problem solving where students integrate teamwork and communication with the use of computer software as tools to solve engineering problems. Design II: GIS incorporates instruction and hands-on exercises in ArcGIS, a geographic information system software package, to enable students to capture, manage, analyze and display spatial data in maps and charts, to solve problems that depend on spatial analysis and orientation GIS for their design solutions. 2 hours lecutre, 3 hours lab; 3 semester hours. Prerequisite: EDNS151, EDNS155, EDNS192, or HNRS115.

EDNS262. DESIGN II: AUTOCAD. 3.0 Semester Hrs.
Equivalent with EPIC262,
(I) Design II: AutoCAD builds on the design process from Design I, which focuses on open-ended problem solving where students integrate teamwork and communication with the use of computer software as tools to solve engineering problems. Design II: AutoCAD incorporates instruction in 3-D AutoCAD computer-aided drawing of elemental designs (structure and mechanical) and geo-spatial designs and analyses to solve problems and publish outcomes. Students are introduced to digital terrain modeling and geo-referencing concepts using AutoCAD Civil3D and raster satellite imagery. Students studying Civil Engineering, Environmental Engineering, and Mining Engineering might consider registering for this course. 2 hours lecture, 3 hours lab; 3 semester hours. Prerequisite: EDNS151, EDNS155, EDNS192, or HNRS115.

EDNS263. DESIGN II: MATERIALS. 3.0 Semester Hrs.
Equivalent with EPIC271,
(II) Design II: Materials builds on the design process introduced in Design I, which focuses on open-ended problem solving where students integrate teamwork and communication with the use of computer software as tools to solve materials engineering problems. The Design II: Materials curriculum matches the standard Design II deliverables but with a focus on Metallurgical and Materials Engineering (MME) based projects. Previous projects have utilized areas such as mechanical testing, bio-materials, semiconductors, ceramics, and non destructive examination to address industrial, environmental, research and geopolitical open-ended problems. 2 hours lecture, 3 hours lab; 3 semester hours. Prerequisite: EDNS151, EDNS155, EDNS192, or HNRS115.

EDNS264. DESIGN II: GEOLOGY GIS. 3.0 Semester Hrs.
Equivalent with EPIC264,
(WI) Design II: GIS builds on the design process introduced in Design I, which focuses on open-ended problem solving in which students integrate teamwork and communication with the use of computer software as tools to solve engineering problems. Computer applications emphasize information acquisition and processing based on knowing what new information is necessary to solve a problem and where to find the information efficiently. There are typically eight geology-based projects in the course, based on the needs of multiple outside clients. Many of the course deliverables are maps with associated data sets. Check with department for semester(s) offered. Prerequisite: EDNS151, EDNS155, EDNS192 or HNRS115.

EDNS269. DESIGN II: ENGINEERING PHYSICS. 3.0 Semester Hrs.
Equivalent with EPIC269,
(I, II, S) Design II: Engineering Physics builds on the design process introduced in Design I, and focuses on open-ended problem solving in which students use teamwork to develop computer software as a tool to solve problems related to engineering physics. Students will learn basic programming skills and apply them to projects that relate to current research and applications of physics. Projects are selected to represent real world physics problems wherein creative and critical thinking skills are necessary. These projects often involve computer-based optimization to obtain a solution. Students will learn how to analyze errors in data, and their effects on data interpretation and decision-making. Engineering Physics majors are encouraged to take this course in the sophomore year. It is open to other students on a space-available basis. 2 hours lecture, 3 hours lab; 3 semester hours. Prerequisite: EDNS151, EDNS155, EDNS192, or HNRS115.

EDNS291. DESIGN UNLEASHED. 3.0 Semester Hrs.
(I) Students explore design as an approach to the world through a series of creative, hands-on projects. Projects are defined through designer goals and evaluated through iterative solution posing. This course investigates how design engineers frame open-ended problems and communicate design solutions. Multiple design challenges encourage the utilization of a variety of tools to further develop and iterate on design solutions and product verification. 5 studio hours; 3 semester hours Prerequisite: EDNS192 or HNRS115 or HASS100, EDNS151. Co-requisite: EDNS200.

EDNS292. DESIGN FOR A GLOBALIZED WORLD. 3.0 Semester Hrs.
(II) This experiential design course focuses on how designers respond to increasing global interdependencies and diverse global cultures. Through a variety of design activities, students engage in systems thinking, strategic social planning, and sustainability analysis while applying skills toward reconciling competing perspectives, goals, and needs. The course also explores students' place in the world and their responsibilities as design engineers, global thinkers, and interdisciplinary problem solvers. Prerequisite: EDNS200, EDNS291.

EDNS298. SPECIAL TOPICS. 1-6 Semester Hr.
(I, II) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once. Variable credit; 1 to 6 credit hours. Repeatable for credit under different titles.

EDNS299. INDEPENDENT STUDY. 1-6 Semester Hr.
(I, II) Individual research or special problem projects supervised by a faculty member, also, when a student and instructor agree on a subject matter, content, and credit hours. Variable credit; 1 to 6 credit hours. Repeatable for credit. Prerequisite: Independent Study form must be completed and submitted to the Registrar.

EDNS301. HUMAN-CENTERED PROBLEM DEFINITION. 3.0 Semester Hrs.
(I, II) This class will equip students with the knowledge, skills and attitudes needed to identify, define, and begin solving real problems for real people, within the socio-technical ambiguity that surrounds all engineering problems. The course will focus on problems faced in everyday life, by people from different backgrounds and in different circumstances, so that students will be able to rise to the occasion presented by future workplace challenges. By the end of this course, students will be able to recognize design problems around them, determine whether they are worth solving, and employ a suite of tools to create multiple solutions. The follow up course --"Design for People" -- will enable students to take the best solutions to the prototype phase. 3 hours lecture; 3 semester hours.

EDNS315. ENGINEERING FOR SOCIAL AND ENVIRONMENTAL RESPONSIBILITY. 3.0 Semester Hrs.
(I, II) (WI) This course explores how engineers think about and practice environmental and social responsibility, and critically analyzes codes of ethics before moving to a deeper focus on macroethical topics with direct relevance to engineering practice, environmental sustainability, social and environmental justice, social entrepreneurship, corporate social responsibility, and engagement with the public. These macroethical issues are examined through a variety of historical and contemporary case studies and a broad range of technologies. Prerequisite: HASS100, and EDNS151 or EDNS192. 3 hours lecture; 3 semester hours.

EDNS325. CULTURAL ANTHROPOLOGY. 3.0 Semester Hrs.
This course is an introduction to the discipline of cultural anthropology, surveying a wide variety of human societies and cultures. Using ethnographic case studies of cultures from around the world and within the U.S., the class will examine some critical areas of anthropological knowledge - with a particular emphasis on global political and economic systems, gender, family, and social inequality - to reveal our own cultural biases and explore other ways of living practiced by peoples around the world. This anthropological perspective will challenge our own assumptions and cultural preconceptions about ourselves, other peoples, and the world around us. The course concludes with a consideration of the relationship between anthropology and engineering. Prerequisite: HASS100, EDNS151, EDNS191. Co-requisite: HASS200, EDNS251, EDNS291.

EDNS375. ENGINEERING CULTURES. 3.0 Semester Hrs.
Equivalent with LAIS375,
This course seeks to improve students? abilities to understand and assess engineering problem solving from different cultural, political, and historical perspectives. An exploration, by comparison and contrast, of engineering cultures in such settings as 20th century United States, Japan, former Soviet Union and presentday Russia, Europe, Southeast Asia, and Latin America. Prerequisite: HASS100. Corequisite: HASS200. 3 hours lecture; 3 semester hours.

EDNS391. DESIGN & MODELING OF INTEGRATED SYSTEMS. 3.0 Semester Hrs.
(I) Complex problems in areas of healthcare, transportation, energy distribution, communication require an integrative solution spanning technical, social, and environmental perspectives.. In this course, students develop an appreciation of systems thinking as a holistic approach to complex problem solving. Students will engage with systems thinking in a way that recognizes the 'whole' of the problem through analyzing interrelationships, attributes, and effects. Students apply systems thinking perspectives to a socio-technical problem, describe the problem through modeling techniques, design a holistic solution, and improve upon the solution through justification and systems thinking approaches. Prerequisite: EDNS292.

EDNS392. DESIGN ENGINEERING APPLICATIONS. 3.0 Semester Hrs.
(II) Being a successful design engineer requires an interdisciplinary outlook, the ability to apply practical and conceptual design tools, and sound analytic judgment. This course culminates the integrative design studio sequence, which explores design techniques; problem-definition-and-solution in complex social, cultural, and political contexts; and the professional design ecosystems in which engineers work. The course offers an advanced opportunity to pair design theory with hands-on design projects, while also being attentive to a systems-approach for engineering design. The course emphasizes professional preparedness by refining students? skills in needs assessment, integrated modes of feasibility analysis, and contextualizing proposed solutions. The course allows students to refine their design engineering competencies and identities while simultaneously clarifying their career goals and preparing for a more meaningful Capstone Design experience. 5 studio hours; 3 semester hours. Prerequisite: EDNS391.

EDNS398. SPECIAL TOPICS. 1-6 Semester Hr.
(I, II) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once. Variable credit; 1 to 6 credit hours. Repeatable for credit under different titles.

EDNS399. INDEPENDENT STUDY. 1-6 Semester Hr.
(I, II) Individual research or special problem projects supervised by a faculty member, also, when a student and instructor agree on a subject matter, content, and credit hours. Prerequisite: ?Independent Study? form must be completed and submitted to the Registrar. Variable credit; 1 to 6 credit hours. Repeatable for credit.

EDNS401. PROJECTS FOR PEOPLE. 3.0 Semester Hrs.
(I, II) Work with innovative organizations dedicated to community development to solve major engineering challenges. This course is open to juniors and seniors interested in engaging a challenging design problem and learning more about Human Centered Design (HCD). The course will be aimed at developing engineering solutions to real problems affecting real people in areas central to their lives. 3 hours lecture; 3 semester hours.

EDNS430. CORPORATE SOCIAL RESPONSIBILITY. 3.0 Semester Hrs.
Equivalent with LAIS430,
Businesses are largely responsible for creating the wealth upon which the well-being of society depends. As they create that wealth, their actions impact society, which is composed of a wide variety of stakeholders. In turn, society shapes the rules and expectations by which businesses must navigate their internal and external environments. This interaction between corporations and society (in its broadest sense) is the concern of Corporate Social Responsibility (CSR). This course explores the dimensions of that interaction from a multi-stakeholder perspective using case studies, guest speakers and field work. Prerequisite: HASS100. Corequisite: HASS200. 3 hours lecture; 3 semester hours.

EDNS475. ENGINEERING CULTURES IN THE DEVELOPING WORLD. 3.0 Semester Hrs.
Equivalent with LAIS475,
An investigation and assessment of engineering problem-solving in the developing world using historical and cultural cases. Countries to be included range across Africa, Asia, and Latin America. Prerequisite: HASS100. Corequisite: HASS200. 3 hours lecture; 3 semester hours.

EDNS477. ENGINEERING AND SUSTAINABLE COMMUNITY DEVELOPMENT. 3.0 Semester Hrs.
(I, II) This course is an introduction to the relationship between engineering and sustainable community development (SCD) from historical, political, ideological, ethical, cultural, and practical perspectives. Students will study and analyze different dimensions of community and sustainable development and the role that engineering might play in them. Also students will critically explore strengths and limitations of dominant methods in engineering problem solving, design, and research for working in SCD. Students will learn to research, describe, analyze and evaluate case studies in SCD and develop criteria for their evaluation. Prerequisite: HASS100. Corequisite: HASS200. 3 hours seminar; 3 semester hours.

EDNS478. ENGINEERING AND SOCIAL JUSTICE. 3.0 Semester Hrs.
Equivalent with LAIS478,
(II) This course offers students the opportunity to explore the relationships between engineering and social justice. The course begins with students? exploration of their own social locations, alliances and resistances to social justice through critical engagement of interdisciplinary readings that challenge engineering mindsets. Then the course helps students to understand what constitutes social justice in different areas of social life and the role that engineers and engineering might play in these. Finally, the course gives students an understanding of why and how engineering has been aligned and/or divergent from social justice issues and causes. Prerequisite: HASS100. Corequisite: HASS200. 3 hours lecture; 3 semester hours.

EDNS479. COMMUNITY-BASED RESEARCH. 3.0 Semester Hrs.
Engineers and applied scientists face challenges that are profoundly socio-technical in nature, and communities are increasingly calling for greater participation in the decisions that affect them. Understanding the diverse perspectives of communities and being able to establish positive working relationships with their members is therefore crucial to the socially responsible practice of engineering and applied science. This course provides students with the conceptual and methodological tools to conduct community-based research. Students will learn ethnographic field methods and participatory research strategies, and critically assess the strengths and limitations of these through a final original research project. Prerequisite: HASS100 or graduate student standing. Co-requisite: HASS200 or graduate student standing.

EDNS480. ANTHROPOLOGY OF DEVELOPMENT. 3.0 Semester Hrs.
Equivalent with LAIS480,
Engineers and applied scientists face challenges that are profoundly socio-technical in nature, ranging from controversies surrounding new technologies of energy extraction that affect communities to the mercurial "social license to operate" in locations where technical systems impact people. Understanding the perspectives of communities and being able to establish positive working relationships with their members is therefore crucial to the socially responsible practice of engineering and applied science. This course provides students with the conceptual and methodological tools to engage communities in respectful and productive ways. Students will learn ethnographic field methods and participatory research strategies, and critically assess the strengths and limitations of these through a final original research project. Prerequisite: HASS200. Co-requisite: EDNS477 or HASS325.

EDNS491. CAPSTONE DESIGN I. 3.0 Semester Hrs.
Equivalent with EGGN491,
(I, II) (WI) This course is the first of a two-semester capstone course sequence giving the student experience in the engineering design process. Realistic open-ended design problems are addressed for real world clients at the conceptual, engineering analysis, and the synthesis stages and include economic and ethical considerations necessary to arrive at a final design. Students are assigned to interdisciplinary teams and exposed to processes in the areas of design methodology, project management, communications, and work place issues. Strong emphasis is placed on this being a process course versus a project course. This is a writing-across-the-curriculum course where students' written and oral communication skills are strengthened. The design projects are chosen to develop student creativity, use of design methodology and application of prior course work paralleled by individual study and research. 2 hours lecture; 3 hours lab; 3 semester hours. Prerequisite: For BSME students, completion of MEGN301; for BSCE students, completion of Engineering Field Session, Civil, CEEN 331; for BSENV completion of Engineering Field Session, Environmental, CEEN 330; and for all other students completion of Field Session appropriate to the student's specialty and consent of instructor. Co-requisite: For BSME students, MEGN481; for BSCE students, any one of CEEN443, CEEN445, CEEN442, or CEEN415; for BSEE students, EENG 350 and EENG 389 plus any one of EENG 391, EENG 392, EENG 393, or EENG 394; for BSE students, EDNS392.

EDNS492. CAPSTONE DESIGN II. 3.0 Semester Hrs.
(I, II) (WI) This course is the second of a two-semester sequence to give the student experience in the engineering design process. Design integrity and performance are to be demonstrated by building a prototype or model, or producing a complete drawing and specification package, and performing pre-planned experimental tests, wherever feasible, to verify design compliance with client requirements. 1 hour lecture; 6 hours lab; 3 semester hours. Prerequisite: EDNS491.

EDNS498. SPECIAL TOPICS. 6.0 Semester Hrs.
(I, II) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once. Variable credit; 1 to 6 credit hours. Repeatable for credit under different titles.

EDNS499. INDEPENDENT STUDY. 1-6 Semester Hr.
(I, II) Individual research or special problem projects supervised by a faculty member, also, when a student and instructor agree on a subject matter, content, and credit hours. Prerequisite: Independent Study form must be completed and submitted to the Registrar. Variable credit; 1 to 6 credit hours. Repeatable for credit.

Department Heads

Dean Nieusma, Department Head

Chelsea Salinas, Assistant Department Head

Professors

Kevin Moore, Executive Director of Humanitarian Engineering

Juan Lucena, Humanitarian Engineering Director of Undergraduate Programs and Outreach

Jessica Smith

Assistant professors

Elizabeth Reddy

Marie Stettler Kleine

Teaching Professors

Yosef Allam

Alina Handorean

Carrie (CJ) McClelland

Teaching Associate Professors

Leslie Light

Mirna Mattjik

Mark Orrs

Sid Saleh

Kate Youmans

Teaching Assistant Professors

Michael Sheppard

Lauren Shumaker, Director of Thorson First-Year Honors Experience

Aubrey Wigner

Kate Youmans, Presidential Faculty Fellow for Diversity, Inclusion & Access (DI&A)

Staff

Becky Buschke, Program Assistant

Leah Fitzgerald, Stakeholder Relations Manager

Cristin Georgis, Research Support

Kirsten Kelly, Capstone Administrative Assistant

Julia Roos, Associate Director of Humanitarian Engineering

Kimberly Walker, Department Manager