

# ENGINEERING, DESIGN, AND SOCIETY (EDNS)

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## **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 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.

## **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 design techniques, business tools, and computer software to solve engineering problems. Student project teams now work with real-world clients while infusing introductory business skills including Agile project management tools, time-value of money and financial project justifications to address client needs. Computer applications emphasize data analytics. Teams build team dynamics and ensure satisfaction of client needs through team meetings and sprint reviews. The course emphasizes oral, visual, and written technical communications techniques introduced in Design I. 2 hours lecture, 3 hours lab; 3 semester hours. Prerequisite: EDNS151, EDNS155, HNRS115, or HNRS120.

**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.

**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.

**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.

**EDNS515. INTRODUCTION TO SCIENCE AND TECHNOLOGY STUDIES. 3.0 Semester Hrs.**

This course engages scholarship on the inextricable link between science, engineering and the various social contexts within which scientists and engineers work. We begin by critically reflecting on the question, What are science and engineering for? We then explore key conceptual domains in the social scientific study of science and engineering, including knowledge, agency, and expertise. We will learn from a diverse set of social scientific experts who study and collaborate with scientists and engineers. Students will leave the course with a better understanding of how social scientific inquiry can aid in understanding, and practicing, science and engineering. They will also have a clearer articulation of their individual professional commitments and how those fit with more traditional understandings of science and engineering.

**EDNS544. INNOV8X. 3.0 Semester Hrs.**

Innov8x introduces concepts and tools to accelerate the design, validation and adoption of innovations in support of creative problem solving. Using an entrepreneurial mindset, we learn how to identify and frame problems that beneficiaries and stakeholders face. We attempt to design and test practical solutions to those problems in collaboration with those who experience the problems. We apply beneficiary discovery, prototyping, business model design (social, economic and environmental), constrained creativity, efficient experimentation, and rapid iteration. While resolving challenges involves technical solutions, an important aspect of this course is directly engaging beneficiaries and stakeholders in social contexts to develop solutions with strong impact potential. Innov8x is grounded in collaborative creativity theory at the intersection of organizational behavior (social psychology), design principles, entrepreneurship and innovation management.

**EDNS577. ADVANCED ENGINEERING AND SUSTAINABLE COMMUNITY DEVELOPMENT. 3.0 Semester Hrs.**

Analyzes the relationship between engineering and sustainable community development (SCD) from historical, political, ethical, cultural, and practical perspectives. Students will study and analyze different dimensions of sustainability, development, and "helping", and the role that engineering might play in each. Will include critical explorations of strengths and limitations of dominant methods in engineering problem solving, design and research for working in SCD. Through case-studies, students will analyze and evaluate projects in SCD and develop criteria for their evaluation. 3 hours lecture and discussion; 3 semester hours.

**EDNS579. COMMUNITY-BASED RESEARCH METHODS. 3.0 Semester Hrs.**

Engineers and applied scientists face challenges that are profoundly sociotechnical 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 graduate students with the conceptual and methodological tools to conduct community-based research. Graduate 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 related to their ongoing independent research or practicums.

**EDNS580. HUMANITARIAN ENGINEERING AND SCIENCE CAPSTONE PRACTICUM. 3.0 Semester Hrs.**

(I, II, S) This course allows students to practice the concepts, theories and methods learned in HES courses with the goal of making relevant their academic training to real world problems. This practicum can be achieved through a number of possibilities approved by HES director, including supervision and/or shadowing in HES-related activities, engaging in a social enterprise where they do problem definition, impact gap analysis and layout a business canvas, and designing and carrying out a project or fieldwork of their own, etc. Prerequisite: EDNS570, EDNS479. 3 hours research; 3 semester hours.

**EDNS590. RISKS IN HUMANITARIAN ENGINEERING AND SCIENCE. 3.0 Semester Hrs.**

(I) This course provides students with opportunities to consider the risks related to humanitarian projects or any projects that effect and involve people. These risks might include things that different scientific and engineering disciplines typically consider, as well as those that may be pertinent to project stakeholder perspectives. Guided by social scientific insights related to risk, students in this class will gain new tools for defining problems in ways that are relevant and appropriate for multiple contexts. Students will read, discuss, and analyze material together and to undertake independent research to deepen their understandings of chosen topics. 3 semester hours.

**EDNS598. SPECIAL TOPICS IN ENGINEERING DESIGN & SOCIETY. 6.0 Semester Hrs.**

(I, II, S) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once, but no more than twice for the same course content. Prerequisite: none. Variable credit: 0 to 6 credit hours. Repeatable for credit under different titles.

**EDNS599. INDEPENDENT STUDY. 0.5-6 Semester Hr.**

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: 0.5 to 6 credit hours. Repeatable for credit under different topics/experience and maximums vary by department. Contact the Department for credit limits toward the degree. Independent Study form must be completed and submitted to the Registrar.