EGE 2123 ENTREPRENEURIAL ENGINEERING DESIGN STUDIO

KEEN STUDENT OUTCOMES AND COMPLEMENTARY SKILLS

COURSE DESCRIPTION: The Entrepreneurial Engineering Design Studio is a sophomore-level course that emphasizes creating solutions through team based projects utilizing engineering tools and skills, along with opportunity identification, ideation, value analysis, and customer engagement.

LEARNING OBJECTIVES

1. Integrate information from a variety of sources to generate, screen, and select promising design opportunities that will create value for potential customers.
2. Assess and manage risk in design choices to organize, plan, and manage a long term engineering project within a team environment.
3. Explore prior and accepted solutions to identify and communicate the value of a unique design solution in terms of economic, personal, and societal value.
4. Describe the perspective of others in order to translate insight gained from customer feedback into design specifications at multiple stages in the design process.
5. Utilize and persist through a systematic design process in order to bring a unique design solution to fruition.
6. Identify and utilize technical tools and skills needed to test concepts quickly via customer engagement and develop a viable design solution.
7. Assess and manage cost, value, and market implications at all stages of development.
8. Communicate design status and results to all stakeholders in verbal, written, and public presentation formats at appropriate points in the development timeline.

Each of these course learning objectives can be mapped to the KEEN framework for entrepreneurially-minded student outcomes (KSO) and complementary skills (KCS) as seen below in the table. The EGE2123 LEARNING OBJECTIVES listed above are parenthetically listed next to the KSO/KCS that each addresses. In the left column of each table, the depth to which each KSO/KCS is addressed overall in the course is expressed as a numerical value as follows:

0 = NO COVERAGE
1 = AWARENESS
2 = UNDERSTANDING
3 = ABILITY

ENTREPRENEURIAL MINDSET

<table>
<tr><td></td><td colspan="3">CURIOSITY</td></tr>
<tr><td>3</td><td>DEMONSTRATE curiosity about our changing world (1,3,4,5,6,7)</td><td>3</td><td>EXPLORE a contrarian view of accepted solutions (1,3,4,5,6,7)</td></tr>
<tr><td></td><td>Application (refer to course materials for more detail) :
What aspects of your project/class involved this type of curiosity?
● Readings and accessibility simulation activities for building empathy
● Painstorming and opportunity identification activities
● Customer engagement

What specific student actions or statements showcased this type of curiosity?
● Activities prompt student questions about how people with disabilities interact with the world around them.
● Students begin to critically analyze customer pain points and needs in order to address them with a design solution.
● Students ask questions to understand customer needs.</td><td></td><td>Application (refer to course materials for more detail) :
What aspects of your project/class involved this type of curiosity?
● Market research activities
● In-class Consulting Days
● Weekly class blog

What specific student actions or statements showcased this type of curiosity?
● Research on prior solutions prompt students to critically assess the strengths and weaknesses of solutions and lead to curiosity in generating concepts that span the design space.
● At specific points in the design process, teams consult with their classmates who provide fresh insight on design decisions.
● Students post replies to weekly blog post with topics ranging from course content, teamwork, entrepreneurial mindset, customer feedback on your designs. Students are required to post comments on their classmates posts.</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="3">CONNECTIONS</td></tr>
<tr><td>3</td><td>INTEGRATE information from many sources to gain insight (1-8)</td><td>2-3</td><td>ASSESS and MANAGE risk (1-8)</td></tr>
<tr><td></td><td>Application (refer to course materials for more detail) :
What aspects of your project/class develop mental habits around connections?
● Customer engagement activities at multiple points within the design process</td><td></td><td>Application (refer to course materials for more detail) :
What aspects of your project/class develop mental habits around connections?
● Outcome Driven Innovation methods to develop customer needs
● Quantifying customer needs through developing target specifications</td></tr>
</table>

	• Market research and investigation of prior solutions • Multiple levels of prototyping for feedback ***What specific student actions or statements showcased connections of this type?*** • Students integrate information from all of aspects of the course experience to inform the technical requirements of their design as they build and test a working prototype.		• Developing a design validation test plan • Cost analysis and comparison based on target costing and BOM costing ***What specific student actions or statements showcased connections of this type?*** • Students focus on their customer's job and look for opportunities for innovation in aspects of the job that may be slow, inefficient, or costly. • Students translate their customer needs into measurable metrics with which they validate the success of their design. • Students are introduced to robust design methodology to identify possible noise factors, unintended functions of their designs, and potential control parameters. These are incorporated in their test plans that they execute with their customer on their working prototypes.
	CREATING VALUE		
3	***IDENTIFY*** *unexpected opportunities to create extraordinary value (1,3,4,5,6,7)*	*3*	***PERSIST*** *through and learn from failure (2,5,6,7)*
	Application (refer to course materials for more detail) : ***What aspects of your project/class promoted creating value?*** • Designing for diverse customers • Painstorming and opportunity identification activities • Customer engagement at multiple points in the design process ***What specific student actions or statements showcased value creation?*** • Student teams design, build, and test a working prototype for their customers. • Designs have been directly informed by customer feedback at multiple points in the design process to insure value creation as defined by the customer.		***Application (refer to course materials for more detail) :*** ***What aspects of your project/class promoted creating value?*** • Iteration through multiple levels of prototyping and customer feedback • Prototype testing and failure analysis ***What specific student actions or statements showcased value creation?*** • Students communicate their design concepts to customers through building mock-up prototypes. • Students execute their test plan with their customer incorporating target specs and noises to validate their working prototypes.

ENGINEERING THOUGHT AND ACTION

3	***APPLY*** *creative thinking to ambiguous problems (1-7)*
2	***APPLY*** *systems thinking to complex problems (4,5,6,7)*
2	***EVALUATE*** *technical feasibility and economic drivers (1, 3 - 7)*
2	***EXAMINE*** *societal and individual needs (1,3,4,5,7)*

COLLABORATION

3	***FORM*** *and work in teams (1-8)*
3	***UNDERSTAND*** *the motivations and perspectives of others (1-8)*

COMMUNICATION

2	***CONVEY*** *engineering solutions in economic terms (3,7,8)*
3	***SUBSTANTIATE*** *claims with data and facts (1,3,4,5,7,8)*

CHARACTER

1	***IDENTIFY*** *personal passions and a plan for professional development (1,2)*
2	***FULFILL*** *commitments in a timely manner (1-8)*
2	***DISCERN*** *and pursue ethical practices (1-8)*
1	***CONTRIBUTE*** *to society as an active citizen (1-7)*

COMPLEMENTARY SKILLS: OPPORTUNITY

3	***IDENTIFY*** *an opportunity (1,3)*
2	***INVESTIGATE*** *the market (1,3,7)*
0	***CREATE*** *a preliminary business model*
3	***EVALUATE*** *technical feasibility, customer value, societal benefits, and economic viability (1, 3-7)*
3	***TEST*** *concepts quickly via customer engagement (1,4,5,8)*
0	***ASSESS*** *policy and regulatory issues*

COMPLEMENTARY SKILLS: DESIGN

3	***DETERMINE*** *design requirements (4,6,7)*
2	***PERFORM*** *technical design (5,6)*
2	***ANALYZE*** *solutions (1,3,5,6)*
0	***DEVELOP*** *new technologies*
3	***CREATE*** *a model or prototype (4,5,6)*
3	***VALIDATE*** *functions (5,6)*

COMPLEMENTARY SKILLS: IMPACT

2	***COMMUNICATE*** *an engineering solution in economic terms (3,7,8)*
3	***COMMUNICATE*** *an engineering solution in terms of societal benefits (3,7,8)*
1	***VALIDATE*** *market interest (1,3,7)*
3	***DEVELOP*** *partnerships and build a team (1-8)*
0	***IDENTIFY*** *supply chains and distribution methods*
1	***PROTECT*** *intellectual property (1,7)*