

Engineering Entrepreneurship (SIE 496 / 596)

Spring 2025, T-Th 12:30-1:45

John Schmidt

Lecturer, Department of Systems and Industrial Engineering

Office: The Refinery, 1600 E. Idea Lane, Suite 110, Tucson, AZ 85713

johnwschmidt@arizona.edu

(703) 347-5260

Virtual Office Hours: T & TR 1-3pm

Additional Office Hours <https://calendly.com/johnwschmidt-arizona/30min>)

Derick Maggard

Director, Startup Wildcats

Tech Launch Arizona Student Ventures

Office: The Refinery, 1600 E. Idea Lane, Suite 110, Tucson, AZ 85713

dmaggard@arizona.edu

(520) 621-0926

Virtual Office Hours: T & TR 1-3pm

Dr. Michael J. Kwinn, Jr.

Director, Engineering Management

Department of Systems and Industrial Engineering

Office: ENGR 107

kwinnm@arizona.edu

845.401.8361

Office Hours: By appointment

Course Description and Overview

The Engineering Entrepreneurship course for Masters CAPSTONE equips students with the essential skills and mindset required to navigate the complex landscape of entrepreneurial ventures within the engineering domain. By blending theoretical frameworks with practical applications, this course guides students through the journey of identifying problems, validating ideas, launching, and scaling successful businesses. Through interactive sessions, case studies, and hands-on projects, students will develop entrepreneurial acumen essential for driving innovation and value creation in today's competitive market. The course also focuses on evaluating the market viability of new ideas, shaping these ideas into the right products or services for the right markets, and developing strategies for product positioning, marketing, and operations. Additionally, students will learn how to acquire necessary resources such as people, financing, and strategic partners, as well as assuming leadership roles in high-tech ventures.

Course Prerequisites

Not Applicable

Course Objectives

This course aims to teach technology analysis and development frameworks and build entrepreneurial thinking:

1. **Develop Entrepreneurial Thinking and Mindset:** Cultivate a robust entrepreneurial mindset, empowering students to think creatively, embrace innovation, and approach challenges with a proactive and solution-oriented attitude.
2. **Conceptualize and Develop Entrepreneurial Ventures:** Equip students with practical approaches and methodologies for conceptualizing, designing, and strategizing entrepreneurial ventures within the engineering domain.
3. **Understand Business Start-up and Growth Complexities:** Foster a deep understanding of the multifaceted requirements, considerations, and challenges involved in starting and growing a successful business.
4. **Identify and Evaluate Opportunities:** Enable students to identify problems, differentiate between ideas and viable opportunities, and develop compelling value propositions that address market needs.
5. **Apply Feasibility and Analysis Frameworks:** Teach students to utilize iterative frameworks for conducting comprehensive feasibility studies, including technological, financial, team, and market analyses.
6. **Master Effective Communication and Team Dynamics:** Develop proficiency in essential skills such as effective communication, project management, stakeholder engagement, and team building to lead and collaborate successfully in entrepreneurial settings.

Graduate students will also:

1. Conduct comprehensive literature review for the course project.
2. Present advanced readings and lead class discussions.
3. Demonstrate deeper comprehension of analytic tools
4. Lead engagements with project stakeholders.

Expected Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Conduct customer discovery to validate market demand and understand customer needs.
2. Validate the proposed solution through feedback from stakeholders in the form of a minimum viable product.
3. Create a Business Model Canvas that aligns with the solution and demonstrates a viable path to market.
4. Present and defend their solution, prototype, and business model to industry stakeholders, showcasing their ability to integrate engineering and business concepts.

Graduate students will additionally:

1. Demonstrate a deeper understanding of the analysis frameworks
2. Conduct and synthesize comprehensive literature and market reviews

3. Show proficiency in leading team and engaging with partners

Course Segments

Segment 1: Problem Identification and Ideation

- **Introduction & Overview**
 - Understanding the course objectives and structure
 - Introduction to entrepreneurship in the engineering domain
- **Problem Identification / Opportunity Recognition**
 - Techniques for identifying problems and pain points in real-world settings
 - Fieldwork: Documenting observed problems
- **Root Cause Analysis & Ideation**
 - Analyzing the root causes of identified problems
 - Ideation techniques for generating potential solutions
 - Fieldwork: Conducting root cause analysis and beginning solution ideation
- **Reading Materials:**
 - Entrepreneurship: Successfully Launching New Ventures, Chapters 1-6

Segment 2: Solution Development and Validation

- **Solution Presentations, Team Formation & IP/Technology Review**
 - Presenting initial solutions
 - Forming teams and conducting a deep dive into problems
 - Reviewing intellectual property and technology considerations
- **Lean Startup Methodology**
 - Introduction to Lean Startup principles
 - Developing problem statements and identifying key stakeholders
 - Fieldwork: Scheduling and conducting stakeholder interviews
- **Value Proposition Canvas & Interview Techniques**
 - Utilizing the Value Proposition Canvas
 - Effective techniques for stakeholder interviews
 - Fieldwork: Preparing and conducting interviews, filling out Empathy Canvas
- **Reading Materials:**
 - Entrepreneurship: Successfully Launching New Ventures, Chapters 7-9
 - Running Lean
 - Lean Startup

Segment 3: Business Model Development

- **Business Model Canvas (Customer Segments, Relationships, Channels)**
 - Developing customer segments, relationships, and channels in the Business Model Canvas
 - Fieldwork: Continuing stakeholder interviews
- **Business Model Canvas (Key Partners, Activities, Resources)**
 - Identifying key partners, activities, and resources
 - Cost structure and revenue streams
 - Fieldwork: Completing Business Model Canvas sections
- **Competitive Analysis & Legal/IP Considerations**
 - Conducting competitive analysis

- Understanding legal and intellectual property considerations
- **Reading Materials:**
 - Entrepreneurship: Successfully Launching New Ventures, Chapters 10-15
 - Business Model Generation

Segment 4: Feasibility and Strategy

- **Marketing and Market Feasibility**
 - Developing marketing positioning strategies
 - Assessing market feasibility
- **Human and Organizational Feasibility**
 - Evaluating human resources and organizational governance
 - Creating organizational and governance documents
- **Technology and Financial Feasibility**
 - Analyzing technology feasibility and requirements
 - Conducting financial feasibility studies and cost accounting
- **Sales Strategies, Scaling Techniques, and Financial Planning**
 - Developing sales strategies and scaling techniques
 - Preparing a comprehensive financial plan and proforma
- **Final Presentations**
 - Presenting final business plans and feasibility studies to the class

Expected Learning Outcomes

Upon successful completion of this course, students will be able to:

5. Conduct customer discovery to validate market demand and understand customer needs.
6. Validate the proposed solution through feedback from stakeholders in the form of a minimum viable product.
7. Create a Business Model Canvas that aligns with the solution and demonstrates a viable path to market.
8. Present and defend their solution, prototype, and business model to industry stakeholders, showcasing their ability to integrate engineering and business concepts.

Graduate students will additionally:

4. Demonstrate a deeper understanding of the analysis frameworks
5. Conduct and synthesize comprehensive literature and market reviews
6. Show proficiency in leading team and engaging with partners

Tentative Lecture Schedule:

Module	(Day) Topic
Module 1:	(T) Introduction & Overview
	(R) Problem ident. / Opportunity Recognition

Module 2:	(T) Root Cause Analysis & Ideation (R) Root Cause Analysis presentations - Solution Creation
Module 3:	(T) Solution Presentations - Team Formation & IP/Technology Review (R) Introduction to Lean Startup Methodology
Module 4:	(T) Value Proposition Canvas - Interviewing techniques (R) Interview progress reports - Empathy Canvas
Module 5:	(T) Interview progress reports - Business model canvas (Customer Segments, Customer relationships, Channels) (R) Present business model canvas section - Discussion on how to find interviews
Module 6:	(T) Interview progress reports - Business model canvas (Key partners, Key Activities, Key Resources) (R) Interview progress reports - Business model canvas - Cost Structure and Revenue Streams
Module 7:	(T) Competitive Analysis - Who is already solving this problem and how are they solving it? (R) Competitive Analysis presentation - Legal & IP Considerations
Module 8:	(T) Mid-term Exam (R) 4 P's of Marketing
Module 9:	(T) Marketing and Market Feasibility (R) Human and Organizational Feasibility
Module 10:	(T) Organizational Governance - Guest Lecture (R) Technology Feasibility
Module 11:	(T) Financial Feasibility (R) Pivot or Persevere - midpoint check-in
Module 12:	(T) Cost Accounting - Guest Lecture (R) Sales strategies & scaling techniques
Module 13:	(T) Preparing a financial plan (R) Effective Business Pitches/Presentations
Module 14:	(T) Semester Review & Working Session for final presentations (R) Working Session for final presentations
Module 15:	(T) Final Presentations (R) Final Presentations

The above topics and schedule are subject to change. Revisions in the syllabus may occur as the semester progresses.

Reading Materials

1. "Entrepreneurship: Successfully Launching New Ventures (What's New in Management)" by Bruce Barringer and R Ireland
ISBN-10: 0132555522
2. "The Lean Startup" by Eric Ries
ISBN: 978-0-307-88789-4
3. "Business Model Generation" by Alexander Osterwalder and Yves Pigneur
ISBN: 978-0-470-87641-1
4. "Running Lean" by Ash Maurya
ISBN: 978-1-449-30517-8

Grading Scale and Grade Policy

1 - Grading:

Course grades for **undergraduate** students will be determined based on the following items:

Course Work	Points	Percentage
Weekly attendance and class participation	10	10%
Mid-term Exam (1)	20	20%
Individual (and team) assignments	30	30%
Final Team Project (1 oral and 1 written report)	40	40%
TOTAL	100	100%

Course grades for **graduate** students will be determined based on the following items:

Course Work	Points	Percentage
Weekly attendance and class participation	10	10%
Mid-term Exam (1)	20	20%
Individual (and team) assignments	10	10%
Literature Review	10	10%
Final Team Project (1 oral and 1 written report)	50	50%
TOTAL	100	100%

The grading scheme will follow the distribution below. University policy regarding grades and grading systems is available at <http://catalog.arizona.edu/policy/grades-and-grading-system>

Points	Percentage	Letter Grade
90-100	90%-100%	A
80-89	80%-89%	B
70-79	70%-79%	C
60-69	60%-69%	D
<60	<60%	E

Students disputing a grade on any grade item (e.g., homework and exam) must do so within a week of the graded work being returned. Note: unexcused absences will not extend this deadline.

2 - Exam

The midterm exam date and time are scheduled based on the course schedule, and all students are required to participate in the exam on time. The only exceptions are medical and job reasons approved by the instructor prior to the exam. Students with disabilities, please contact the Disability Resource Center (DRC).

Students should read the exam instruction carefully before it starts, whether it is open-book or a close-book exam. If it is an open-book exam, students who forget to bring a textbook or other materials, are not allowed to borrow books or other materials from other students in the exam room.

The mid-term exam for the Engineering Entrepreneurship course will assess students' understanding and application of the key concepts covered in the first half of the course. This exam will ensure that students have grasped the foundational principles necessary to identify problems, recognize opportunities, and develop innovative solutions. It will evaluate their proficiency in problem identification, root cause analysis, and the generation of creative solutions. Additionally, the exam will test students' understanding of the Lean Startup Methodology, the use of the Value Proposition Canvas, and the Business Model Canvas. Students will also be assessed on their ability to conduct effective customer interviews and analyze competitive landscapes. The exam will consist of multiple-choice questions, short answers, and case-based questions, emphasizing the integration of course concepts, analytical skills, and the application of theoretical knowledge to practical scenarios. This comprehensive assessment will demonstrate students' readiness to progress in the course and their ability to propose viable entrepreneurial solutions.

3 – Individual Assignments & Fieldwork

Individual assignments in this course include guest lecture reflections, book reviews/essays, and fieldwork, all aimed at deepening students' understanding of innovation and entrepreneurial concepts. After attending guest lectures, students will write reflections summarizing key insights and discussing their application to their own projects. Book reviews or essays will involve critically evaluating selected readings on entrepreneurship and

innovation. Fieldwork assignments will include market research, customer interviews, or competitive analysis, with students documenting and analyzing their findings. These assignments will be evaluated based on analysis depth, writing clarity, and the ability to connect theory with practice, fostering independent learning and practical application of entrepreneurial principles.

Individual assignments and fieldwork will be given throughout the semester, typically with one week to complete, and should be done individually unless specified otherwise. All fieldwork must be submitted on D2L before the due date and time. If work is submitted elsewhere (like the instructor's or TA's door), students are responsible for any missing assignments and will incur penalties until the work is found or resubmitted. Late homework penalties are as follows: up to 24 hours late, a 20% deduction; up to 48 hours late, a 50% deduction; more than 48 hours late, no credit given. This policy applies to all students unless prior consent is given by the instructor for medical or job reasons. Solutions will be posted on the third day after the deadline and discussed in class.

4 – Course Project

Students will work in groups of 3 to 5 with the prior consent of the instructor. In the team-based project, students will select a piece of technology intellectual property (IP) and collaboratively build a comprehensive business case and market assessment around it. This project will involve evaluating the potential applications and market demand for the chosen technology, identifying target customers, and analyzing competitive landscapes. Students will develop a strategic plan that includes value proposition, business model, and go-to-market strategy. By working in teams, students will gain hands-on experience in leveraging IP for entrepreneurial ventures, honing their skills in innovation management, market analysis, and strategic business planning. The project culminates in a presentation where teams pitch their business case to a panel of industry experts and potential investors, simulating real-world entrepreneurial challenges and opportunities.

Grading criteria will focus on the thoroughness of market research, the feasibility and innovation of the business model, the quality of strategic planning, and the effectiveness of the final presentation. Teams will be assessed on their ability to integrate course concepts into their project, demonstrating critical thinking, problem-solving, and creativity.

Late submissions will incur penalties to emphasize the importance of meeting professional deadlines: late by up to 24 hours will result in a 15% deduction, late by 24-48 hours will result in a 40% deduction, and submissions more than 48 hours late will not be accepted without prior arrangement. Exceptions may be granted for documented emergencies, ensuring fairness while maintaining high standards of accountability and time management.

5 – Teamwork Evaluation

Project team members will use a Teamwork Evaluation Form to rate their own and their teammates' contributions to the project components (proposal, presentation, and report) on a scale from 0 to 10 (0 meaning no contribution, 10 meaning the greatest contribution). Each person's teamwork score for each component will be the average of all team members' ratings, including their own, scaled by 10. For example, if student A's proposal scores from five team members are 10, 9, 8, 7, and 6, A's teamwork score will be $(10+9+8+7+6)/5/10 = 0.8$. If the

team receives a project score of 30, A's adjusted proposal score will be $30 \times 0.8 = 24$. The final project score, with a maximum of 40 points, will be the sum of the scores for the project proposal and the final project (written and oral).

6 – Weekly Attendance & Participation

Evaluating participation in this course will involve a combination of self-assessments, guest lecture reflections, peer evaluations, and instructor observations. Students are expected to actively engage in discussions, contribute meaningfully to team projects, and demonstrate initiative in problem-solving activities. Participation will be assessed based on the quality and frequency of contributions during class sessions, the level of engagement in team collaborations, and the ability to provide constructive feedback to peers. The instructor will also monitor attendance and punctuality as indicators of commitment. Regular self-assessments and peer evaluations will help ensure that students reflect on their participation and receive feedback on their performance, fostering a collaborative and accountable learning environment.

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>.

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, see: <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <http://policy.arizona.edu/employmenthuman-resources/attendance>.

Classroom Behavior Policy:

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Mainly from the university classroom policy (adopted by the Faculty Senate):

- Not leaving early. Early leaving will distract both the instructor and students
- Not talking with other classmates while the instructor or another student is speaking. If a student has a question or comment, he or she should raise a hand, rather than starting a conversation about it with a neighbor
 - Not packing backpacks to leave until the instructor has dismissed class
 - Showing respect and concern for others by not monopolizing class discussion.

Students must allow others time to give their input and ask questions. Students should not stray from the topic of class discussion

- Not eating and drinking during class time

Academic Integrity and Code of Academic Integrity:

Students are encouraged to freely discuss course materials and share intellectual views. However, graded assignments must reflect independent effort unless specified otherwise. Students are expected to uphold the UA Code of Academic Integrity as outlined in the UA General Catalog. For details, please refer to <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>. The University Libraries offer valuable resources on avoiding plagiarism, accessible at <http://new.library.arizona.edu/research/citing/plagiarism>.

Selling class notes or course materials to others without the instructor's explicit written consent is prohibited. Violations of this policy and other course rules are subject to the UA Code of Academic Integrity and may lead to disciplinary actions. Using D2L or UA email to sell or purchase copyrighted materials may also constitute a violation of student conduct and copyright laws.

The instructor and TA will rigorously examine all homework, reports, and exams to prevent plagiarism. For instance, copying others' homework or discussing exam content during exams is strictly prohibited. TAs will thoroughly review assignments to detect any instances of plagiarism, even if the output is from the same software, based on writing style and formatting. During exams, both TAs and students are vigilant for any signs of cheating, and seating arrangements are designed to prevent collaboration.

Send Feedback to US:

If you have any questions, suggestions or comments related to the class, you are very welcome to contact the instructor or TA. We have several ways for communications:

- In-class feedback
- Office hours
- Emails
- Individual appointment (if you cannot come in office hour)
- Feedback in D2L

Threatening Behavior Policy:

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See: <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

UA Nondiscrimination and Anti-harassment Policy:

The University is committed to creating and maintaining an environment free of discrimination, see: <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>.

Inclusive Excellence is a fundamental part of the University of Arizona's strategic plan and culture. As part of this initiative, the institution embraces and practices diversity and inclusiveness. These values are expected, respected and welcomed in this course.

This course supports elective gender pronoun use and self-identification; rosters indicating such choices will be updated throughout the semester, upon student request. As the course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect.

Additional Resources for Students Statement: Office of Diversity
(<http://diversity.arizona.edu/>)
<http://www.health.arizona.edu/counseling-and-psych-services>

Accessibility and Accommodations (for students with Disability)

Accessibility and Accommodations: At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, <https://drc.arizona.edu>) to establish reasonable accommodations.

Requests for incomplete (I) or withdrawal (W)

Such requests must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>
Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Subject to Change Statement

The information contained in the course syllabus, may be subject to change, as deemed appropriate by the instructor, see <http://policy.arizona.edu/faculty-affairs-and-academics/course-syllabus-policy-undergraduate-template>. <https://policy.arizona.edu/faculty-affairs-and-academics/course-syllabus-policy-graduate>