CE596-01
Entrepreneurship and Business Strategy in Engineering

Course: CE596-01 "Entrepreneurship and Business Strategy in Engineering"

Credits: 3 credit hours

Meeting time: M, W, F: 8:30 – 9:20 am

Location: WALC 1132

Brightspace: https://purdue.brightspace.com

Prerequisite: None

Description: This course offers students the opportunity to learn and apply the core skills required to build and grow engineering- and technology-based businesses through lecture, case discussions, and weekly activities tied to a semester-long team project. Course content includes market analysis techniques to link technology attributes to opportunity and vice versa, combinatorial business design and planning methods, strategic innovation theories, competitive analysis, methods of emergent strategy and risk mitigation, as well as examination of team building, firm influence and navigation, and organizational design principles. Emphasis throughout is placed on the implications of research and development uncertainty, long-lifecycle economics, and the management of subcontracts and multi-disciplinary teams often encountered when developing and delivering complex engineering outputs. Case studies are used to contrast the challenges faced when creating new businesses (entrepreneurial) with those encountered in attempts to grow an existing enterprise (intrapreneurial). Coursework and project activities also facilitate development of business acumen, and skill building in conceptual thinking, synthesis, and persuasive communication. This course is particularly relevant for engineering students intending to progress into managerial roles in technology or R&D driven organizations.

This course can be counted toward the College of Engineering Minor in Innovation and Transformational Change and the Burton D. Morgan Center for Entrepreneurship (BDMCE) Certificate in Entrepreneurship and Innovation.

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

1. Articulate the similarities and differences between entrepreneurship and intrapreneurship
2. Employ open-ended problem solving techniques to identify opportunities to grow or transform new or existing organizations and/or commercialize new technologies
3. Utilize and interpret qualitative and quantitative issue and market analysis

methods to understand and/or quantify the level of market interest in an idea
4. Understand and apply theories of innovation to define competitive market entry strategies
5. Employ combinatorial business design methods to explore and prioritize alternative paths to achieve financial sustainability for an idea
6. Employ principles of risk mitigation and emergent strategy to define the assumptions underlying new ideas and explore paths to capture market value
7. Perform and interpret financial evaluations of new ideas and businesses
8. Interpret the tradeoffs of varying legal and management structures for a new enterprise
9. Recognize influence paths in an organization and/or market ecosystem and tailor oral and written communications accordingly

Alignment with standards:

ABET Standard	***Corresponding Course Content***
A. Ability to apply mathematics, science and engineering principles	Team assignments and presentations and lectures on the cash flow cycle and innovation science
B. Ability to design and conduct experiments, as well as to analyze and interpret data	Lectures on interpreting trends and scenarios; team project involving market assessment and in-market experimentation
C. Ability to design a system, component, or process to meet desired needs	Team assignments and presentations and lectures on understanding markets and ecosystems, ideating responsive solutions, and designing a business model
D. Ability to function on multidisciplinary teams	Team project building a student-proposed business; lectures on developing and managing a masterplan to drive growth across and organization and building and running teams
E. Ability to identify, formulate, and solve engineering problems	Lectures on pursuing innovation, identifying strategic opportunity areas, defining strategic intent, and ideating responsive solutions
G. Ability to communicate effectively	Weekly team oral presentations and concise written summaries of key concepts and project deliverables
H. The broad education necessary to understand the impact of engineering solutions in a global and societal context	Team project to develop a business that has regional, national, and/or international implications

Instructor:

Professor Joe Sinfield
Office: HAMP G231
Phone: 765-496-2742
E-mail: jvs@purdue.edu

Grading:

Weight	Activity
50%	Term project: The term project is developed by teams of 4 to 6 students working collaboratively to produce ~ 10 weekly deliverables tied to the business development process. Each of these deliverables includes a brief write-up, a single well developed visual, and a brief oral presentation. A final, integrated report and ~20-30 minute presentation must also be delivered at the end of the semester. A peer evaluation of team members and class evaluation of the final presentation is also associated with the project.
20%	Homework and cases: Brief individual written assignments to identify and describe contemporary examples of key course concepts and/or present insights from case studies.
25%	Quizzes: ~30-40 minute individual written quizzes to assess student knowledge of key concepts, theories, and language.
5%	Individual engagement and case/project leadership.

Learning resources:

Text: **The Innovator's Guide to Growth: Putting Disruptive Innovation to Work** by Scott D. Anthony, Mark W. Johnson, Joseph V. Sinfield, and Elizabeth J. Altman (Harvard Business Press, 2008). [GTG]

Brightspace: Brightspace will be used to provide access to all course lecture content, and may also be used to manage some course learning evaluation mechanisms (e.g., homework, quizzes or exams) [https://purdue.brightspace.com]

Assignments:

No assignments can be missed without penalty, unless the missed assignment is authorized by the instructor. Assignment due dates/times will be posted with each assignment.

Attendance:

Synchronous participation in class sessions and team working sessions is required. In-person attendance is desirable but not mandatory. Students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus. In the current context of COVID-19, in-person attendance will not be a factor in final grades, but the student still needs to inform the instructor of any conflict that can be anticipated and will affect the submission of an assignment or the ability to take an exam. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email,

through Brightspace, or by phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.

Guidance in the event of quarantine/ isolation:

If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.

Classroom Guidance Regarding Protect Purdue:

The Protect Purdue Plan, which includes the Protect Purdue Pledge, is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask in classrooms and campus buildings, at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus

room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights.

Academic integrity:

Students are expected to uphold all university policies and regulations on academic integrity and conduct. Academic dishonesty will not be tolerated, and any acts of academic dishonesty will be dealt with on a case by case basis. Penalties for violations will be levied at the discretion of the instructor and may include but are not limited to reduction in the grade received for an assignment or exam, loss of credit for an assignment or exam, reduction in the FINAL grade for the course, and/or failure of the course.

The University Senate has stipulated that:
"the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest" [University Senate Document 72-18].

Students are reminded of the Purdue Honor Pledge: “As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.”

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

For further information note that Brightspace includes a link to Purdue’s Student Guide for Academic Integrity under University Policies.

Use of copyrighted works:

Students are expected, within the context of the Regulations Governing Student Conduct and other applicable University policies, to act responsibly and ethically by applying the appropriate exception under the Copyright Act to the use of copyrighted works in their activities and studies.

Class notes in any form are “considered to be ‘derivative works’ of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials.” As such, they cannot be sold or bartered without the instructor’s express written permission. For further details on related

University policy, see part J of the Purdue student miscellaneous conduct regulations.

The University does not assume legal responsibility for violations of copyright law by students who are not employees of the University.

Behavior: Disruptive behavior will not be tolerated. You may be asked to leave class. Examples include: arriving late, talking during lecture, making inappropriate comments, sleeping, leaving early, engaging in activities not related to class (e.g. texting, other homework).

Nondiscrim-ination Statement: Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. More details are available on our course Brightspace table of contents, under University Policies.

Accessibility: Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

Mental Health Statement: **If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack.** Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, and stress, sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 (or visit http://www.purdue.edu/caps/) during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Emergency preparation:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted on the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

EMERGENCY NOTIFICATION PROCEDURES are based on a simple concept – if you hear a fire alarm inside, proceed outside. If you hear a siren outside, proceed inside.

Indoor Fire Alarms mean to stop class or research and immediately **evacuate** the building. Proceed to your Emergency Assembly Area away from building doors. **Remain outside** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.

All Hazards Outdoor Emergency Warning Sirens mean to immediately seek shelter (**Shelter in Place**) in a safe location within the closest building.

"Shelter in place" means seeking immediate shelter inside a building or University residence. This course of action may need to be taken during a tornado, a civil disturbance including a shooting or release of hazardous materials in the outside air. Once safely inside, find out more details about the emergency*. **Remain in place** until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.

**In both cases, you should seek additional clarifying information by all means possible…Purdue Home page, email alert, TV, radio, etc…review the Purdue Emergency Warning Notification System multi-communication layers at http://www.purdue.edu/ehps/emergency_preparedness/warning-system.html*

EMERGENCY RESPONSE PROCEDURES:

• Review the **Emergency Procedures Guidelines** https://www.purdue.edu/emergency_preparedness/flipchart/index.html

• Review the **Building Emergency Plan** (available from the building deputy) for:

- evacuation routes, exit points, and emergency assembly area,

- when and how to evacuate the building,
- shelter in place procedures and locations,
- additional building specific procedures and requirements.

MORE INFORMATION
Reference the Emergency Preparedness web site for additional information:
http://www.purdue.edu/emergency_preparedness

Course outline:

Week	***Topic***	***Reading***
1	Entrepreneurship vs. Intrapreneurship	Sarasvathy, 2001; Solis and Sinfield, 2016
	How Businesses Work	
	· Organizational design and implications	Dranove et al. 2015 - Ch. 17
	· Business functions	N/A
2-3	· The cash flow cycle	Brigham and Gapenski 2010 - Ch. 1
	· The growth challenge	GTG, Ch. 1; Brealey et al. 2016 - Part 10; Copeland et al. 1995 - Part I.3
	· Innovation processes	Anthony et al., 2008a; Garcia et al., 2012
	Developing a Growth Idea	Anthony et al., 2008b; Sinfield and Anthony 2006
4	· Identifying strategic opportunities	GTG Ch. 2, ; Anthony and Sinfield, 2007; Johnson and Sinfield 2008
5	· Focusing through purpose-context	GTG Ch 4; Sheth and Sinfield, 2020
6	· Estimating demand	N/A
7	· Performing competitive analysis	Porter 2008
8-9	· Defining strategic intent and ideating responsive solutions	GTG Ch. 5, 6; Sinfield et al. 2014; Dewar and Dutton, 1986; Ettlie et. al., 1984; Damanpour, 1996; Anderson and Tushman, 1990; Henderson and Clark, 1990; Tushman and Murmann, 1998; Baldwin and Clark, 2000; Schilling 2000
9-10	· Balancing strategy, price, and value	Sinfield et al. 2007
10-11	· Designing a business model	Weill et al. 2004; Liu et al. 2020; Sinfield et al. 2012
12	· Developing an engagement and positioning strategy	GTG Ch. 7
13-14	· Assessing financial prospects	Brealey et al. 2016 - Part 9; Brigham and Gapenski 2010 - Ch. 2, 3
15	· Refining your business model, in market	Mintzberg and Waters 1985; McGrath and MacMillan 1995
	Organizing to Innovate	GTG CH. 9

*Schedule is approximate and will be adjusted based on class engagement and progress.

Reading list: Readings will be drawn from the following references:

Text:
The Innovator's Guide to Growth: Putting Disruptive Innovation to Work by Scott D. Anthony, Mark W. Johnson, Joseph V. Sinfield, and Elizabeth J. Altman (Harvard Business Press, 2008). [GTG]

Peer reviewed literature and industry publications:

1. Anderson, P. and Tushman, M. L., (1990) Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change, *Administrative Science Quarterly*, Vol. 35, No. 4, pp. 604-633
2. Anthony, S.D., Johnson, M. W., Sinfield, J.V., (2008a) "Institutionalizing Innovation," *Sloan Management Review*, v. 49, n. 2, 45-50, Winter.
3. Anthony, S., Johnson, M., and Sinfield, J., (2008b) "Driving Growth Through Innovation" *Financial Executive*, v. 24 n. 8, 38-43, October.
4. Anthony, S. D., and Sinfield, J.V. (2007) "Product for Hire: Master the Innovation Lifecycle with a Jobs-to-be-Done Perspective of Markets", *Marketing Management*, March/April, 19-24.
5. Baldwin, C., & Clark, K. (2000). **Design rules: the power of modularity**. Cambridge, MA: The MIT Press.
6. Brealey, R.A., Myers, S.C., and Allen, F., (2016) **Principles of Corporate Finance**, McGraw-Hill-Irwin, 976 pp. [12th ed.]
7. Brigham, E. and Gapenski, L. **Financial Management – Theory and Practice**, (2010) South-Western College Pub, 1184 pp. [13th ed.]
8. Copeland, T., Koller, T. and Murrin, J., (1995) **Valuation: Measuring and Managing the Value of Companies**, Wiley, 576 pp. [2nd ed.]
9. Damanpour, F. (1996). Organizational Complexity and Innovation: Developing and Testing Multiple Contingency Models. *Management Science*, 42(5), 693 - 716.
10. Dewar, R., and Dutton, J. (1986). The Adoption of Radical and Incremental Innovations: An Empirical Analysis. *Management Science*, 32(11), 1422 - 1433.
11. Dranove, D., Besanko, D., Shanley, M., and Schaefer, S., (2015) **Economics of Strategy**, Wiley, 544 pp. [7th ed.]
12. Ettlie, J.E. Bridges, W.P. and O'Keefe, R.D. (1984) "Organization Strategy and Structural Differences for Radical Versus Incremental Innovation," *Management Science* 30, (6): 682-695
13. Garcia, J.C., Sinfield, J.V., Yadav, A., and Adams, R.S. "Enhancing Student Attitudes Toward Learning through Entrepreneurially Oriented Case-Based Instruction," International Journal of Engineering Education, Volume 28, No. 2. 2012.
14. Henderson, R., and Clark, K. (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*, 35(1), 9- 30.
15. Johnson, M., and Sinfield, J., (2008) "Focusing on Consumer Needs is Not Enough," *Advertising Age*, April 28.

16. Liu, J., Tong, T., and Sinfield, J.V., (2020). "Toward a Resilient Complex Adaptive System View of Business Models," Long Range Planning, August.
17. McGrath, R., and MacMillan, I. (1995). Discovery-driven planning. *Harvard Business Review*, 73(4), 44-54.
18. Mintzberg, H., and Waters, J. (1985). Of strategies, deliberate and emergent. *Strategic Management Journal*, 6(3), 257-272.
19. Porter, M. E. (2008) "The Five Competitive Forces that Shape Strategy", *Harvard Business Review*, January, p.86-104.
20. Sarasvathy, S (2001): What makes entrepreneurs entrepreneurial, Darden Business Publishing, University of Virginia, UVA-ENT-0065.
21. Schilling, M. (2000). Toward a General Modular Systems Theory and its Application to Interfirm Product Modularity. *Academy of Management Review*, 25(2), 312 - 334.
22. Sheth, A., and Sinfield, J.V., (2020). "Systematic Problem Specification in Innovation Science Using Language," International Journal of Innovation Science.
23. Sinfield, J. and Anthony, S. (2006) "Constraining Innovation: How Developing and Continually Refining Your Organization's Goals and Bounds Can Help Guide Growth", *Strategy & Innovation*, November – December, v. 4, n. 6, 1, 6-9.
24. Sinfield, J.V., Gustafson, T., and Hindo, B. (2014) "The Discipline of Creativity," *Sloan Management Review*, 55(2), 24-26, Winter.
25. Sinfield, J.V., (2007) "Gives, Gets, and the Good Enough: A methodical, consumer driven approach to cutting features, benefits—and costs", *Strategy & Innovation*, November – December, v. 5, n. 6, 1, 6-10.
26. Sinfield, J.V., Calder, E.S., Colson, S., McConnell, B., (2012) "How to Identify New Business Models," *Sloan Management Review*, v. 53, n. 2, Winter.
27. Solis, F., and Sinfield, J.V., "From Entrepreneur to Designer: The Transferable Design Principles of the Entrepreneur," (2016) ASEE Annual Conference & Exposition, Jazzed about Engineering Education, June 26-29, 2016, New Orleans, LA, Paper ID#15965.
28. Tushman, M., and Murmann, J. (1998). Dominant Designs, Technology Cycles, and Organizational Outcomes. *Research in Organizational Behavior*, 20, 231 - 266.
29. Tushman M.L. and P. Anderson, P. (1986) "Technological discontinuities and organizational environments", *Administrative Science Quarterly*, 31, 439-65.
30. Weill, P., Malone, T. W., D'Urso V.T., Herman, G. and Woerner S. (2004) "Do Some Business Models Perform Better Than Others?" MIT Sloan School of Management Working Paper/ MIT Center for Coordination Science Working Paper No. 226, 6 May.