Office of the Registrar
FORM 40G REV. 1/17

PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF A GRADUATE COURSE
(50000-60000 LEVEL)

PRINT

DEPARTMENT: Civil Engineering EFFECTIVE SESSION: Spring 2018

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- [x] 1. New course with supporting documents (complete proposal form)
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [ ] 5. Change in course title
- [ ] 6. Change in course credit/type
- [ ] 7. Change in course attributes
- [ ] 8. Change in instructional hours
- [ ] 9. Change in course description
- [ ] 10. Change in course requisites
- [ ] 11. Change in semesters offered
- [ ] 12. Transfer from one department to another

PROPOSED:		EXISTING:	
Subject Abbreviation	CE	Subject Abbreviation	
Course Number	59901	Course Number	
Long Title	Entrepreneurship and Business Strategy in Engineering		
Short Title			

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

TERMS OFFERED
Check All That Apply:
- [x] Fall
- [ ] Spring
- [ ] Summer

CAMPUS(ES) INVOLVED
- [ ] Calumet
- [ ] Cont Ed
- [ ] Ft. Wayne
- [ ] Indianapolis
- [ ] N. Central
- [ ] Tech Statewide
- [ ] W. Lafayette

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range:
   Minimum Cr. Hrs
   (Check One) To [ ] Or [ ]
   Maximum Cr. Hrs
3. Equivalent Credit: Yes [ ] No [ ]
4. Thesis Credit: Yes [ ] No [ ]

COURSE ATTRIBUTES: Check All That Apply
1. Pass/Not Pass Only [ ]
2. Satisfactory/Unsatisfactory Only [ ]
3. Repeatable [ ]
   Maximum Repeatable Credit: [ ]
4. Credit by Examination [ ]
5. Fees [ ] Coop [ ] Lab [ ] Rate Request [ ]
   Include comment to explain fee
6. Registration Approval Type
   Department [ ] Instructor [ ]
7. Variable Title [ ]
8. Honors [ ]
9. Full Time Privilege [ ]
10. Off Campus Experience [ ]

Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	50	3	16	100
Recitation				
Presentation				
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS): (Note: If description will not fit in space provided, please create a separate document and attach to this form.)

see attached

*COURSE LEARNING OUTCOMES: (Note: If course learning outcomes will not fit in space provided, please create a separate document and attach it to this form.)

see attached

Calumet Department Head	Date	Calumet School Dean	Date	Calumet Director of Graduate Studies	Date
Fort Wayne Department Head	Date	Fort Wayne School Dean	Date	Fort Wayne Director of Graduate Studies	Date
Indianapolis Department Head	Date	Indianapolis School Dean	Date	IUPUI Associate Dean for Graduate Education	Date
North Central Department Head	Date	North Central School Dean	Date	North Central Director of Graduate Studies	Date
West Lafayette Department Head	11/13/17 Date	West Lafayette College/School Dean	Date	Date Approved by Graduate Council	Date
Graduate Area Committee Convener	Date	Graduate Dean	Date	Graduate Council Secretary	Date
				West Lafayette Registrar	Date

OFFICE OF THE REGISTRAR

Grad Form 40G must include the Graduate Council's supporting document, which is available at http://www.purdue.edu.registrar/forms/form_40_Intro.html

To: The Faculty of the College of Engineering

From: Lyles School of Civil Engineering of the College of Engineering

RE: New Graduate Course, CE 59601 Entrepreneurship and Business Strategy in Engineering

The faculty of the School of Civil Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

CE 59601 Entrepreneurship and Business Strategy in Engineering
Sem. 1, Lecture 3, Cr. 3
Prerequisites: Graduate standing is recommended. Exceptions may be granted by permission of the instructor.

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.

Reason: This course specifically contextualizes entrepreneurial principles for engineers and engineering centric enterprises, and directly aims to develop Purdue's Engineer of 2020 Target Attributes in entrepreneurial and intrapreneurial thinking, open-ended design and problem solving, and recognition and management of change, among others, helping to fulfill the College's vision to prepare Purdue engineers for leadership roles in the 21st century.

This course has been offered 9 times as a CE597 course, with the following enrollments: Fall 07(30), 08(36), 09(21), 10(18), 11(33), 13(19), 14(28), 15(30), 16(20)

Raj S. Govindaraju, Bowen Engineering Head of Civil Engineering
Lyles School of Civil Engineering

Supporting Document to the Form 40G for a New Graduate Course

To: Purdue University Graduate Council

From: Faculty Member: Joseph Sinfield
Department: Lyles School of Civil Engineering
Campus: West Lafayette

Date:

Subject: Proposal for New Graduate Course-Documentation Required by the Graduate Council to Accompany Registrar's Form 40G

Contact for information if questions arise:
Name: Teresa L. Cadwallader
Phone: 765-494-0987
E-mail: tlc3764@purdue.edu
Address: ARMS 3000

Course Subject Abbreviation and Number: CE 59601

Course Title: Entrepreneurship and Business Strategy in Engineering

A. Justification for the Course

This course specifically contextualizes entrepreneurial principles for engineers and engineering centric enterprises, and directly aims to develop Purdue's Engineer of 2020 Target Attributes in entrepreneurial and intrapreneurial thinking, open-ended design and problem solving, and recognition and management of change, among others, helping to fulfill the College's vision to prepare Purdue engineers for leadership roles in the 21st century.

There are intentionally no field-specific prerequisites for the course to allow engineers new to the disciplines of entrepreneurship and strategy to develop business acumen. For each topic explored in the course, content is presented by initiating concept and case discussions with fundamental principles, theories, and language, and then building to more complex and integrated views that are then applied in class exercises and term-project activities. The course provides comprehensive coverage of the considerations and activities involved in formulating and growing an enterprise based on the evolution of an idea from initial conceptualization to user-centric design of an offering and related financially sustainable business model.

This course has been offered 9 times with the following enrollment: F07 (30), F08 (36), F09 (21), F10(18), F11(33), F13(19), F14(28), F15(30), F16 (20).

B. Learning Outcomes and Method of Assessment

Learning Outcomes – 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

Relation to ABET Standards

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, 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

Relation to Engineer of 2020 Target Attributes

Target Attribute	***Corresponding Course Content***
Decision-making ability	Team assignments and presentations, as well as lectures on differentiating types of opportunities, selecting priority customer segments, and prioritizing business concepts
Ability to synthesize engineering, business, and societal perspectives	Team assignments and presentations, as well as lectures on organizational design, business functions, the cash flow cycle, customer segmentation, strategic intent, designing a business model, taking control of the value chain, assessing sources of competition, developing a go-to-market approach, and assessing financial prospects, all in relation to the nature of a new idea
Open-ended design and problem solving skills	Team project to design and develop a student-proposed business from initial idea conceptualization to fully formulated go-to-market plan and testing approach
Analytical skills	Lectures on issue, market, and business financial analysis from both qualitative and quantitative perspectives
Innovative mindset	Lectures on innovation forms, linking strategy and innovation, and processes to drive innovation
Adaptability in a changing environment	Team assignments and presentations and lecture on ecosystem analysis and competitive strategy

Method of Assessment – These learning outcomes are assessed as follows

Weight	Activity
50%	Term project: The term project is developed by teams of 3 to 5 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 an 8 minute oral presentation. A final, integrated report and 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 accounts for 5.0 of the 50 points associated with the project.
20%	Homework and cases: Brief individual written assignments (< 3 pages) to identify and describe contemporary examples of key course concepts and/or present insights from case studies (typically 5-7 assignments)
25%	Quizzes: 30 minute individual written quizzes to assess student knowledge of key concepts, theories, and language (typically 3-4 quizzes)
5%	Participation: Leadership of at least one in-class case discussion and 2 weekly project deliverable presentations.

Method of Instruction – Lecture and Case Discussion
The course is anchored on lectures, case discussions, and working exercises that highlight core business development concepts, principles, and theories. Each concept is explored by students as individuals through case analysis and/or homework assignments, examined in class in case discussions, and then employed by student teams in the context of their specific term-project business idea. Weekly report-outs of interim project deliverables by the project teams then foster deeper discussion of the core concepts, engage students in peer-to-peer feedback, and provide the entire class with diverse examples of the concepts in action across the array of project ideas pursued by the different teams.

C. Prerequisite(s)
There are no field-specific prerequisites. Graduate or senior level undergraduate standing is recommended. Exceptions may be granted by permission of the instructor.

D. Course Instructors

Name	**Rank**	**School**	**Graduate Faculty**
Joe Sinfield	Associate Professor	Civil Engineering	Yes

E. Course Outline

Week	*Topic*	*Sub-topic*	*Reading*
1	I. II.	Entrepreneurship vs. Intrapreneurship How Businesses Work A. Organizational design and implications	Dranove et al. 2015 - Ch. 13
2		B. Business functions C. The cash flow cycle	Brigham and Gapenski 2010 - Ch. 1

3	D. The growth challenge E. Strategies and innovation forms for growth	Brealey et al. 2016 - Part 10 Copeland et al. 1995 - Part I.3
4	F. Linking strategy and innovation G. Differentiating types of opportunities	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
5	III. Pursuing Growth (for new or existing enterprises) A. Processes to drive innovation	Anthony et al., 2008a
6	B. Developing and communicating a growth idea 1. Understanding markets and ecosystems	GTG Ch. 1; Anthony et al., 2008b; Sinfield and Anthony 2006 GTG Ch. 2, 3
7	2. Interpreting trends and scenarios	Anthony and Sinfield, 2007; Johnson and Sinfield 2008
8	3. Identifying strategic opportunity areas 4. Selecting priority customer segments 5. Defining strategic intent	 GTG Ch 4 GTG Ch. 5, 6
9	6. Ideating responsive solutions 7. Balancing strategy, price, and value	Sinfield et al. 2014 Sinfield et al. 2007
10	8. Designing a business model	Weill et al. 2004; Johnson et al. 2008; Sinfield et al. 2012
11	9. Prioritizing business concepts 10. Taking control of the value chain 11. Assessing sources of competition	 Porter 2008
12	12. Developing a go-to-market approach	GTG Ch. 7
13	13. Assessing financial prospects 14. Refining your business model, in market	Brealey et al. 2016 - Part 9; Brigham and Gapenski 2010 - Ch. 2, 3 Mintzberg and Waters 1985; McGrath and MacMillan 1995
14	IV. Organizing to Innovate A. Structures to facilitate growth	 GTG CH. 9

15		B. Developing and managing a masterplan C. Building and running teams	GTG Ch. 7, 8
16	V.	Communicating and Measuring Performance	GTG Ch 10

F. Reading List

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]

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. 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.
14. Johnson, M., and Sinfield, J., (2008) "Focusing on Consumer Needs is Not Enough," *Advertising Age*, April 28.
15. Johnson, M., Christensen, C., and Kagermann, H. (2008). Reinventing your business model. *Harvard Business Review*, December, 51-59.
16. McGrath, R., and MacMillan, I. (1995). Discovery-driven planning. *Harvard Business Review*, 73(4), 44-54.
17. Mintzberg, H., and Waters, J. (1985). Of strategies, deliberate and emergent. *Strategic Management Journal*, 6(3), 257-272.

18. Porter, M. E. (2008) "The Five Competitive Forces that Shape Strategy", *Harvard Business Review*, January, p.86-104.
19. Schilling, M. (2000). Toward a General Modular Systems Theory and its Application to Interfirm Product Modularity. *Academy of Management Review*, 25(2), 312 - 334.
20. 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.
21. Sinfield, J.V., Gustafson, T., and Hindo, B. (2014) "The Discipline of Creativity," *Sloan Management Review*, 55(2), 24-26, Winter.
22. 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.
23. 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.
24. Tushman, M., and Murmann, J. (1998). Dominant Designs, Technology Cycles, and Organizational Outcomes. *Research in Organizational Behavior*, 20, 231 - 266.
25. Tushman M.L. and P. Anderson, P. (1986) "Technological discontinuities and organizational environments", *Administrative Science Quarterly*, 31, 439-65.
26. 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.

G. Library Resources

Readings and resources for this course are readily accessed by students through the Purdue University Libraries.