**DEPARTMENT** Engineering Education  
**EFFECTIVE SESSION** 200910

**INSTRUCTIONS:** Please check the items below which describe the purpose of this request.
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:**
- Subject Abbreviation: ENE
- Course Number: 502
- Long Title: History and Philosophy of Engineering Education
- Short Title: Hist Phil ENE

**EXISTING:**
- Subject Abbreviation: 
- Course Number: 

**TERMS OFFERED:**
- Check All That Apply:
  - Summer
  - Fall
  - Spring

**CAMPUS(ES) INVOLVED:**
- Calumet
- Cont Ed
- Ft. Wayne
- Tech Statewide
- W. Lafayette
- Indianapolis

**CREDIT TYPE**

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<th>Meetings Per Week</th>
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**COURSE ATTRIBUTES:**
- Check All That Apply:
  1. Pass/Not Pass Only
  2. Satisfactory/Unsatisfactory Only
  3. Repeatable
  4. Credit by Examination
  5. Special Fees

**COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):**
Examines the history and philosophy of engineering education by 1) exploring the history of engineering education through archival research and historical documents (critical moments, tensions, issues), 2) investigating philosophies of education and the philosophies that have guided engineering as a profession, and 3) critiquing the evolution of engineering education, identifying alternative scenarios, and imagining a future role in engineering education. This course introduces students to the field of engineering education while broadening their views of the roles of interrelationships between teaching and research.

**DATE**

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**OFFICE OF THE REGISTRAR**

(Grad Form 40G [Excel format] - Does not include the Graduate Council's required supporting document. See pdf version of Form 40G)
Supporting Document for a New Graduate Course

To: Purdue University Graduate Council
From: Faculty Member: Robin Adams and Alice Pawley
        Department: School of Engineering Education
        Campus: Purdue University, 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: Cindey Hays (Temporary)
                                        Phone Number: 43884
                                        E-mail: isenberg@purdue.edu
                                        Campus Address: ARMS 1321

Course Subject Abbreviation and Number: ENE 502
Course Title: History and Philosophy of Engineering Education

A. Justification for the Course:
   • Provide a complete and detailed explanation of the need for the course (e.g., in the preparation of students, in providing new knowledge/training in one or more topics, in meeting degree requirements, etc.), how the course contributes to existing fields of study and/or areas of specialization, and how the course relates to other graduate courses offered by the department, other departments, or interdisciplinary programs.

   • Justify the level of the proposed graduate course (50000- or 60000-level) including statements on, but not limited to: (1) the target audience, including the anticipated number of undergraduate and graduate students who will enroll in the course; and (2) the rigor of the course.

B. Learning Outcomes and Method of Evaluation or Assessment:
   • Describe the course objectives and student learning outcomes that address the objectives (i.e., knowledge, communication, critical thinking, ethical research, etc.).

   • Describe the methods of evaluation or assessment of student learning outcomes. (Include evidence for both direct and indirect methods.)

   • Grading criteria (select from dropdown box); include a statement describing the criteria that will be used to assess students and how the final grade will be determined.

Criteria Papers and Projects
• Identify the method(s) of instruction (select from dropdown box) and describe how the methods promote the likely success of the desired student learning outcomes.

**Method of Instruction** Lecture

C. **Prerequisite(s):**

• List prerequisite courses by subject abbreviation, number, and title.

• List other prerequisites and/or experiences/background required. If no prerequisites are indicated, provide an explanation for their absence.

D. **Course Instructor(s):**

• Provide the name, rank, and department/program affiliation of the instructor(s).

• Is the instructor currently a member of the Graduate Faculty?  X  Yes  __  No (If the answer is no, indicate when it is expected that a request will be submitted.)

E. **Course Outline:**

• Provide an outline of topics to be covered and indicate the relative amount of time or emphasis devoted to each topic. If laboratory or field experiences are used to supplement a lecture course, explain the value of the experience(s) to enhance the quality of the course and student learning. For special topics courses, include a sample outline of a course that would be offered under the proposed course.

F. **Reading List (including course text):**

• A primary reading list or bibliography should be limited to material the students will be required to read in order to successfully complete the course. It should not be a compilation of general reference material.

• A secondary reading list or bibliography should include material students may use as background information.

G. **Library Resources**

• Describe the library resources that are currently available or the resources needed to support this proposed course.

H. **Example of a Course Syllabus** (While not a necessary component of this supporting document, an example of a course syllabus is available, for information, by clicking on the link below, which goes to the Graduate School’s Policies and Procedures Manual for Administering Graduate Student Programs. See Appendix K.)

ENE 502 - History and Philosophy of Engineering Education

A. Justification for the Course:

The course is explicitly identified in the ENE PhD requirements as a "foundation course" required for all students.

As a foundation course, it provides an intellectual framework for identifying research opportunities in engineering education in terms of the nature of engineering, the purpose and process of engineering education, and drivers for leadership and change in engineering education. These topics are synergistic with the five research areas defined by the national Engineering Education Research Colloquium (engineering epistemology, learning mechanisms, learning systems, diversity and inclusiveness, and assessment methodologies). As such, the course has a history of attracting students from the College of Education who are broadly interested in STEM topics and is likely to be of interest to graduate students in other Departments, Schools, or Colleges with engineering education or related interests.

Since many of the students who enter the ENE program come from diverse engineering and in some cases non-engineering backgrounds, the course also serves as an entry point for developing core ENE competencies (which are required as part of the ENE PhD graduate requirements). In particular: think critically and reflectively, communicate knowledge, synthesize knowledge, and participate actively in professional community.

The course also provides an important foundation for the following ENE required courses:
- Theories of Development and Engineering Thinking – by providing rich opportunities to discuss and critique perspectives on the nature of engineering thinking and the role of engineering education in developing engineering thinking.
- Leadership, Policy and Change in STEM Education – by identifying and critiquing drivers for change in engineering education including perspectives that are typically included or excluded in decision making.
- Pedagogy, Content, and Assessment – by inquiring into the aims and process of engineering education (e.g., instruction, pedagogy, and assessment).

The level of the proposed course is at the 50000-level because (1) the target audience is ENE PhD students (approximately 12-16 graduate students per Fall term), (2) successful completion of the course requires students of high intellectual rigor who can synthesize and critique diverse perspectives, make and support claims regarding engineering education, and apply their knowledge to articulate future roles and opportunities in engineering education, (3) instructional techniques require a substantial level of reflection, critique, and argumentation, and (4) course assignments are based on an ability to critique, synthesize, and apply knowledge (which represent attributes of higher level thinking).

B. Learning Outcomes and Method of Evaluation or Assessment:

Course objectives: The purpose of this course is to (1) develop a culture of critical reflection, engagement, and collaborative learning, (2) provide opportunities for students to identify and understand tools to inquire into the history and philosophy of engineering education and develop the skills for using these tools, and (3) provide opportunities for students to use these inquiry tools to form persuasive arguments about the nature of engineering education. These course objectives map to the following ENE PhD competencies: think critically and reflectively, communicate knowledge, synthesize knowledge, and participate actively in professional community.

Student learning outcomes (skills, knowledge, values, identity) that address course objectives (1, 2, 3 above) and ENE PhD competencies are identified in the table below.

Objective 1A: Develop general values associated with critical thinking and reflection
- Instructional objectives: Opportunities to stretch and broaden my view, challenge my point of view, clarify my ideas through writing, and express and explain my own views in class;
- Skills: Learn how to recognize and evaluate arguments through different epistemological lenses and modes of persuasive evidence;
- Knowledge: Identify and synthesize contexts and epistemologies that have shaped and continue to
shape engineering education, including who gets to be an engineer and the goals-aims-purpose-process of engineering education;

- **Values**: Become more comfortable with sitting with/in/around intellectual tensions regarding the nature of engineering, the paradoxes of boundaries and definitions, and multiple epistemic ways of knowing;
- **Link to ENE Graduate Competencies**: Think critically and reflectively, communicate knowledge, synthesize knowledge;

**Objective 1B: Develop a culture of intellectual engagement, both inside and outside ENE**

- **Instructional objectives**: Instructors who are actively helpful when students have problems, respect student questions or comments, and provide a meaningful learning experience;
- **Identity**: Develop into an active contributing member of the Purdue ENE scholarly community, and the engineering education research community more broadly;
- **Values**: Become comfortable participating in a community that values curiosity, a culture of play, boundary blurring, and respect for different (and often competing) perspectives
- **Link to ENE Graduate Competencies**: Participate actively in professional community

**Objective 1C: Engage with others to learn together**

- **Instructional objectives**: Team teaching, classroom discussion, opportunity to learn from other students and through group and collaborative work;
- **Link to ENE Graduate Competencies**: Communicate knowledge

**Objective 2: Develop (specific) skills and apply (specific) tools to be able to think critically and reflectively about “engineering education”**

- **Instructional objectives**: Opportunities to synthesize knowledge from many sources;
- **Skills**: Become facile with using philosophical and historical modes of inquiry in order to make visible, critically reflect on, and compare engineering and educational epistemologies;
- **Knowledge**: Problematize different ways of knowing including articulating and justifying your own way of knowing; identify, understand and use tools and frameworks for critical reflection and analysis of philosophical, epistemological, and historical arguments (e.g., insider and outsider perspectives, philosophies of education, epistemological perspectives, and archival research and historical documents to reveal enacted philosophies of engineering education);
- **Link to ENE Graduate Competencies**: Synthesize knowledge

**Objective 3A: Apply tools to synthesize knowledge**

- **Instructional objectives**: Provide tools for critical reflection, analysis, and synthesis;
- **Knowledge**: Identify, understand and use tools and frameworks for comparison analysis (i.e., what is engineering, who gets to be an engineer, what is the purpose and process of engineering education, and what shapes engineering education?); identify and synthesize perspectives on the nature of engineering (what engineers know and how they know it);
- **Link to ENE Graduate Competencies**: Synthesize knowledge

**Objective 3B: Develop my own perspective/identity on engineering**

- **Instructional objectives**: Provide background for further study, be intellectually fulfilling, and support professional growth;
- **Identity**: Begin to develop an identity as an engineering education researcher – and your potential in shaping engineering as a profession, the education of engineers, and the work of engineering education researchers
- **Link to ENE Graduate Competencies**: Engage in professional development

**Methods of evaluation and assessment**

Grading criteria: Papers and projects

Criteria used to assess students and articulate final grades are based on four tasks weighted as a percentage of the total final grade (see table below).

**Task 1** is “engagement”**: based on weekly class discussion (attendance and engagement). Students are required to contact the instructors regarding absences and must complete an additional task as a 15% of total grade (assessed weekly)

The total grade is based on the following guideline: an A for engaging in all classes, a B for missing 2 classes or not contributing during 75% of the class meetings, a C for
substitute for missing class discussion. Students may complete additional work to compensate for up to 2 absences.

**Task 2** is "reflection blog posts", based on contributions to the course blog that are used to prepare students for substantive class discussions. 10% of total grade (assessed weekly)

**Task 3** involves three "synthesis-identity essays" that each map to a major course theme (nature of engineering, purpose of education, philosophy of engineering education) and provide opportunities for students to reflect on their role as future engineering educators in relation to the goals, aims, and process of engineering education. Individual essays are expected to be between 4 and 7 pages double-spaced, and are reviewed by instructors and peers with opportunities to incorporate feedback. 45% of total grade (each essay is 15%)

**Task 4** is a group YouTube video (2 minutes minimum, 10 minutes maximum) that presents a philosophy for the future of engineering education (using ideas from discussions, reflection blogs, and synthesis-identity essays) and will be presented in class. Accompanying the video is a brief rationale that includes (1) who the message is intended for, and why, and (2) what message you hoped to send, and why. 30% of total grade

There are multiple points for instructor and peer feedback. The YouTube feedback criterion addresses levels of "completeness", "grounded arguments", "well-organized", "clear", and "engaging". The final grade is based on incorporating feedback based on the criterion.

**Method of instruction**

Lecture

The instructional approach is based on extensive classroom discussion, reflection assignments, and instructor and peer feedback on course projects. Course projects complement instruction by providing opportunities to iteratively synthesize course topics and collaboratively apply knowledge to develop a philosophical statement on the purpose and process of engineering education (see table above).

Instruction focuses on examining the history and philosophy of engineering education through tools and frameworks that guide critical reflection and analysis of philosophical, epistemological and historical arguments regarding (1) what is (and should be) considered engineering, (2) what is (and should be) the purpose and process of engineering education, (3) who gets to be an engineer (and who should be), and (4) what shapes these decisions (and what should shape them)? Tools and frameworks include: reflective practice and paradox, insider and outsider perspectives on engineering, philosophies of education, archival research and historical documents, and boundary work (as a tool for understanding how disciplinary boundaries are managed).

Instructional methods promote likely success of desired student learning outcomes because they focus on building skills in reflection, critique, argumentation, and synthesis necessary for producing high quality course projects that target course learning goals. In addition, course projects are iteratively developed with multiple opportunities for peer and instructor feedback.

**C. Prerequisite(s):**

There are no course prerequisites. Because ENE does not provide a Master's degree and students apply to ENE from a broad range of disciplines (engineering, physics, math, etc.) it would be difficult to define a set of course prerequisites. In addition, as a foundation class the expectation is that this course provides a foundation for future ENE courses.
While there are no prerequisites, interested students must be currently enrolled in a graduate program at Purdue University. Graduate students not in the ENE program must request permission to enroll from the instructor.

D. Course Instructor(s):
Dr. Robin Adams, Assistant Professor, School of Engineering Education
Dr. Alice Pawley, Assistant Professor, School of Engineering Education

Both instructors are currently members of the Graduate Faculty.

E. Course Outline:
The tentative syllabus below describes course topics and indicates the relative amount of time devoted to three topic areas: philosophy of education, nature of engineering, and history of engineering education. The readings below suggest the current plan and may be modified over the course of the semester.

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<tr>
<td>Before classes start</td>
<td>Read Schön and Palmer; may pre-read Noddings</td>
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<tr>
<td>Week 1</td>
<td><strong>Introduction; Talking tools (critical reflection, paradox)</strong></td>
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<tr>
<td>Week 2</td>
<td><strong>Foundational philosophies of education, part 1: the purpose of education and who should be educated; Tools (goals-aims-process of education, who is educated, consequences)</strong></td>
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<tr>
<td>Sept 3</td>
<td>Noddings, Chapters 1-4</td>
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<td>Week 3</td>
<td><strong>Foundational philosophies of education, part 2: the purpose of education and who should be educated; Tools (epistemology, what is persuasive)</strong></td>
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<td>Noddings, Chapters 5-7</td>
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<td>Week 4</td>
<td><strong>Taxonomies of learning: How epistemologies frame educational practice; Tools (boundary work, classification schemes)</strong></td>
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<td>Week 5</td>
<td><strong>YouTube skills</strong></td>
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<td>Sept 24</td>
<td>Assignment: read peers' synthesis papers, provide feedback</td>
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<td>Week 6</td>
<td><strong>What do engineers describe as engineering? ; Tools (insider perspectives on engineering)</strong></td>
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<td>Assignment</td>
<td>Synthesis paper on education.</td>
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<td>Week 7</td>
<td><strong>Engineering as science and as a profession; Tools (boundary work)</strong></td>
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Engineering Profession. Chapters 2-3, pp. 25-78.

Assignment: Bring in a page from your transcripts (just the classes you took, not your grade) of your bachelor's in engineering degree.

**Week 8**
**Oct 15**

**Engineering as design; Tools (boundary work)**

Read one of the following:

**Week 9**
**Oct 22**

**Engineering by outsiders; Tools (outsider perspectives, boundary work, engineering in the wild)**

**Week 10**
**Oct 29**

**What is engineering education?; Tool (Engineering education in the wild)**

Assignment: Engineering education in the wild (see Hutchins)
Peer review of synthesis essay

**Week 11**
**Nov 5**


**History of engineering education, part 1; Tools (archival research and historical documents)**

Read one of:

**Assignment: synthesis essay on education due.**

**History of engineering education, part 2; Tools (boundary work)**

**Examples of bridging philosophy and practice**
(Read either ethics set, or critical theory set)

**Ethics readings:**
- Noddings, Chapter 8
- Harding (2008)

**Critical theory readings:**
- Noddings, Chapter 9

**Week 14**
**Nov 26**
**THANKSGIVING**
No class.

**Week 15**
**Dec 3**

**Engineering education research and Scholarship of Teaching and Learning (SOTL)- Present and Future Views**

ASEE (in press) "Creating a Culture for Systematic and Scholarly Engineering Educational Innovation: Ensuring U.S. engineering has the right people with the right talent for a global society".


**Week 16**
**Dec 10**

**Synthesis of the course**

**Assignment: Peer review of synthesis essays**

**Final exam week**

Final presentations: YouTube videos and rationale

**Assignment: Synthesis essay on engineering education due.**

**F. Reading List (including course text):**
- Other readings identified in course outline.

**G. Library resources:**
- Noddings (2007) is available on library reserve
- All other readings are available on Blackboard Vista.