Master Course Description for EE-406 (ABET sheet)

Course Prefix & Number: E E 406

Title: Teaching Engineering

Credits: 3 (Lecture)

Quarter: Variable

General Education Designation: Diversity (DIV)

Coordinator: Denise Wilson, Professor, Electrical and Computer Engineering

Course Description: Explores effective and inclusive teaching techniques in engineering and related STEM fields including active and problem-based learning with attention to how racial, ethnicity, gender, and socioeconomic differences affect how students learn and interact with teachers including faculty and teaching assistants.

Goals: EE406 looks at teaching practices for delivering high quality instruction and developing an effective teaching climate in the engineering classroom. Although content knowledge is an essential ingredient to good teaching, it does not alone ensure a good teaching experience for students and teachers alike. EE406 looks at proven pedagogical practices including problem-based learning, cooperative learning, and other active learning practices that can support improving quality of instruction in a variety of engineering learning environments. The course also addresses how to provide students with an equitable learning experience and how to build belonging and inclusivity in the classroom, in small groups, and in student teams. Students will gain an understanding of best practices for teaching and learning that fit the engineering environment.

Learning Objectives: At the end of this course, students will be able to:

- 1. *Articulate* individual interests in teaching engineering.
- 2. *Define* major phases in cognitive development according to widely accepted educational psychology theories.
- 3. *Apply* the engineering design cycle to the design, construction, and testing of a hands-on learning activity.
- 4. *Teach* an interactive learning activity to a target secondary school or college audience
- 5. *Describe* active learning techniques that are best suited to teaching engineering
- 6. *Name and Describe* barriers to equity (e.g., macho culture, marginalization, isolation) facing women, students of color, or other underrepresented groups based on evidence in the existing research literature.

- 7. *Define* belonging and its primary antecedents in a teaching and learning context
- 8. *Identify* best practices for building a strong and inclusive teaching climate in the engineering classroom.
- 9. *Lead* class discussions effectively.
- 10. *Work* in diverse teams with a blend of knowledge and skills.

Textbook/Reading:

- 1. Teaching Engineering (Wankat & Oreovicz)
- 2. How People Learn (National Academies Press)
- 3. Articles on equity and inclusivity/belonging in the college classroom

Prerequisites:

1. None

Topics:

- 1. How People Learn, Basic Principles 2 weeks
- 2. Traditional Engineering Teaching Practice 1 week
- 3. Active Learning Practices Techniques applied to Engineering Topics/Learning 2 weeks
- 4. Engineering design and hands-on learning activity design 1
- 5. Belonging and inclusivity in the engineering classroom, laboratory, and other learning environments -1 week
- 6. Barriers to equity among engineering and STEM students -- 1 week
- 7. Building a strong Teaching Climate and Environment for Learning 2 weeks

Course Structure:

The class meets for two 80-minute sessions or three 50-minute sessions per week. Weekly assignments and in-class discussions emphasize deeper understanding of the reading assignments and main concepts of the week. With some variation, half of the weekly session time will consist of lecture and in-class discussion while the other half will focus on bringing in guest teachers/speakers or role-playing problems associated with known issues with inclusivity and equity in the engineering learning environment.

A design project focuses on the design, construction, and testing of a learning activity on an engineering topic/concept directed to an audience chosen by the design team (elementary, middle school, high school, undergraduate). EE406 includes multiple field trips to observe engineering teaching in action either on the UW campus or in K-12 classrooms in the Puget Sound area.

Necessary Resources:

Homework and design project preparation/demonstration can be done on a PC. Construction of learning activities can be completed with on-campus Maker space resources or at-home resources. No laboratory resources are required.

Grading:

Discussion boards or similar forums will account for 20% of the grade. Role-playing activities will account for 20% of the grade and will alternate with short quizzes/concept checks based on the course reading (also 20% of the grade). The learning activity design report, presentation, and demonstration account for 40% of the grade and will require that the student address a combination of pedagogical best practices, inclusion and equity, and assessment of student learning.

One discussion board per week for at least eight of ten weeks of the course will be offered to students. Students have the option of (a) engaging in verbal discussion during class with their peers (with facilitation by the instructor); (b) attending a virtual, online session in the evening to engage in verbal discussion with their peers (with facilitation by the instructor); or (c) participating in written exchanges online with peers. The third option will be least desirable as verbal exchange is pedagogically most beneficial to genuine discourse among students. The topics of discussion each week will enable students to reflect on the readings and their own experiences with regard to the readings. In their original posts (and responses to the posts of others) on discussion boards, students will be expected to respond to prompts and include elements of their verbal exchanges with other students as well as of the week's readings.

Role-playing activities will provide contextualized examples of difficult situations in the engineering classroom and other learning environments related to student-student interactions and student-instructor interactions and offer students a chance to discuss and reflect on how they, as peers or as teachers, can facilitate inclusive and equitable responses to these situations. Students will role-play as a small group, discuss the results of the role-play, devise strategies to address the situations at hand, and enact or reflect on those strategies in short, written assignments or oral debrief to the class.

Diversity and Inclusion:

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the quarter so that I may make appropriate changes to my records.

Accommodations & Access:

"If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course. If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-

related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu or disability.uw.edu. DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between the student, instructor, and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law."**Religious Accommodation**:

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at <u>Religious Accommodations Policy</u>

<u>(https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/)</u>. Accommodations must be requested within the first two weeks of this course using the <u>Religious Accommodations Request form</u>

(https://registrar.washington.edu/students/religious-accommodations-request/).

Safety:

Call SafeCampus at 206-685-7233 anytime – no matter where you work or study – to anonymously discuss safety and well-being concerns for yourself or others. SafeCampus's team of caring professionals will provide individualized support, while discussing short-and long-term solutions and connecting you with additional resources when requested.

Academic Integrity/Misconduct:

The University takes academic integrity very seriously. Behaving with integrity is part of our responsibility to our shared learning community. If you're uncertain about if something is academic misconduct, ask me. Acts of academic misconduct may include but are not limited to:

- Cheating (working collaboratively on quizzes/exams and discussion submissions, sharing answers and previewing quizzes/exams)
- Plagiarism (representing the work of others as your own without giving appropriate credit to the original author(s))
- Unauthorized collaboration (working with each other on assignments)

Engineering is a profession demanding a high level of personal honesty, integrity and responsibility. Therefore, it is essential that engineering students, in fulfillment of their academic requirements and in preparation to enter the engineering profession, shall adhere to the University of Washington's <u>Student Code of Conduct</u> (<u>https://www.washington.edu/cssc/for-students/student-code-of-conduct/</u>). Concerns about behaviors prohibited by the Student Conduct Code will be referred for investigation and adjudication by the College of Engineering Dean's Office and the University's Office of Community Standards and Student conduct

See <u>CoE website</u> (<u>https://www.engr.washington.edu/current/policies/academic-integrity-misconduct</u>) for more detailed explanation of the academic misconduct adjudication

process. Any student found to have committed academic misconduct will receive a 0-grade on impacted academic work (e.g., assignments, project, or exams).

Title IX:

"UW, through <u>numerous policies</u>, prohibits sex- and gender-based violence and harassment, and we expect students, faculty, and staff to act professionally and respectfully in all work, learning, and research environments. For support, resources, and reporting options related to sex- and gender-based violence or harassment, visit UW Title IX's webpage (https://www.washington.edu/titleix/), specifically the Know Your Rights & Resources guide (https://www.washington.edu/titleix/files/2020/08/KYRR-guide-8-10-2020-LINKED.pdf).

If you choose to disclose information to me about sex- or gender-based violence or harassment, I will connect you (or the person who experienced the conduct) with resources and individuals who can best provide support and options. You can also access those resources directly:

- Confidential: Confidential advocates (https://www.washington.edu/sexualassault/support/advocacy/) will not share information with others unless given express permission by the person who has experienced the harm or when required by law.
- Private and/or anonymous: SafeCampus (https://www.washington.edu/safecampus/) provides consultation and support and can connect you with additional resources if you want them. You can contact SafeCampus anonymously or share limited information when you call

Please note that some senior leaders and other specified employees have been identified as "Officials Required to Report." (https://www.washington.edu/titleix/title-ix-officials-required-to-report/) If an Official Required to Report learns of possible sex- or gender-based violence or harassment, they are required to call SafeCampus and report all the details they have in order to ensure that the person who experienced harm is offered support and reporting options (https://www.washington.edu/titleix/resources/)."

Inclement Weather:

Please check if the campus may be closed due to weather. Information on suspension of operations will be made public and available through the media. You can learn of campus operations status by signing up with an alert system that will contact you via email or text message if classes are canceled or delayed (<u>https://www.washington.edu/safety/alert/</u>). Alternatively, campus status during inclement weather is available via local radio and television news.

ABET Student Outcome Coverage: This course addresses the following outcomes:

H = high relevance, M = medium relevance, L = low relevance to course.

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics **(M)** The course requires the development and application of fundamental physical principles (of science and engineering) to the effective design, demonstration, and evaluation of a science/engineering learning activity.

(3) An ability to communicate effectively with a range of audiences **(H)** Students learn how to adjust teaching strategy to meet the needs of a variety of target audiences for teaching engineering. Students communicate strategies for effective teaching verbally and in written form.

(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. (M) Students evaluate and design learning activities in the context of ethical and professional teaching practice with an emphasis on how engineering can benefit society with particular emphasis on addressing social and environmental challenges. At least one weekly reflection addresses how and why engineering learning should include consideration of social and environmental impacts. The culminating, learning activity design project for the course requires students to present and teach in a manner that reflects current ethical codes of conduct in both engineering and teaching.

(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives **(H)** Teams of two to three students are required to work in design teams together to design, build, test, and revise an interactive learning activity in engineering for a target audience in high school or college. Teams of four to six students also lead and facilitate weekly discussions on the background readings.

(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies **(M)** Students gain and apply state-of-the-art knowledge in pedagogical strategy and in the development of effective teaching climates. Students learn major stages of cognitive development and apply this knowledge to the design of an engineering learning activity and teaching of that activity to a target student audience.

Prepared By: Denise Wilson

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