Master Course Description for EE-406 (ABET sheet)

Title: Teaching Engineering
Credits: 3 (Lecture)

UW Course Catalog Description

Coordinator: Denise Wilson, Professor, Electrical and Computer Engineering

Goals: This course provides an overview of practices for delivering high quality instruction and developing an effective teaching climate in the engineering classroom, whether at K-12 levels, in college, or in informal learning environments. Although content knowledge is an essential ingredient to good teaching, it does not alone ensure a good teaching experience for students and teachers alike. This course will look 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. It will also address how to build good working relationships with students in the context of a supportive teaching climate and modern day educational practice and technologies. Students will gain an understanding of best practices that fit the engineering learning environment at multiple ages of instruction.

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 K-16 audience
5. Describe active learning techniques that are best suited to teaching engineering
6. Identify best practices for building a strong teaching climate in the engineering classroom.
7. Lead class discussions effectively.
8. Work in teams with a blend of knowledge and skills.

Textbook/Reading:

1. Teaching Engineering (Wankat & Oreovicz)
2. Engineering in Elementary STEM Education (Cunningham)
3. How People Learn (National Academies Press)
Prerequisites:

1. Junior, Senior, or Graduate Level Standing or Instructor Permission

Topics:

1. How People Learn, Basic Principles at college, elementary, and middle/high school levels - 2 weeks
2. Traditional Engineering Teaching Practice - 1 week
3. Active Learning Practices Techniques applied to Engineering Topics/Learning - 3 weeks
4. Engineering design and hands-on learning activity design - 2 weeks
5. Building a strong Teaching Climate and Environment for Learning - 2 weeks

Course Structure: The class meets for two 80 minute lectures or three 50 minute sessions per week. Weekly reflection assignments emphasize deeper understanding of the reading assignments and main concepts of the week. 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 both on the UW campus and in K-12 classrooms in the Puget Sound area.

Computer and Laboratory 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: Weekly reflections related to lectures and course content account for approximately 30% of the final grade. The learning activity design report, presentation, and demonstration account for approximately 50% of the grade. Concept checks and quizzes account for 20% of the grade.

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.

2. 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.
(3) 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.

(4) 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 K-16. Teams of four to six students also lead and facilitate weekly discussions on the background readings.

(5) 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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