

Syllabus
ISG 531: Teaching Engineering (1 credit)
Fall (A Term) 2004

Location:
TBA, WPI

Instructor:
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INTRODUCTION TO COURSE

Teaching engineering requires the general skills of teaching—structure, guiding, practice, caring, listening, being enthusiastic. But it also requires special skills involving problem solving, strong use of visual organization and heuristics, and familiarity with technology. This course provides a brief review of the general skills; therefore the *Seminar in College Teaching* (IDG 501) is not a prerequisite. However, those who have taken IDG 501 will perform better in this course and get more out of it.

This course deals as much with what the ultimate students are being taught (engineering skills) as it does with what the present students are being taught (teaching skills). Engineering might be defined as problem solving through technology. So teachers themselves must have skills in problem solving and be able to guide the development of these skills in students. Heuristics, visualization, and an intuitive approach are integral to these skills.

Students in this course will actively participate through presenting lectures, leading discussions, performing evaluations, and participating in discussions. They will also produce a portfolio with a design for an engineering course, including course objectives, textbook, lecture topics, sample lecture with visuals, sample homework and test, lab topics, and a sample lab.

COURSE OBJECTIVES

After successfully completing this course, the student will be able to:

1. Organize the concepts and objectives to be covered in an engineering course.
2. Design activities to promote discovery and provide practice in these concepts and objectives.
3. Interact with students in a way that leads to discovery and prompts problem solving skills.
4. Incorporate visual methods of conveying intuition in engineering concepts.
5. Motivate and evaluate students.

COURSE MEETINGS

The course will consist of seven weekly classroom meetings on Thursdays from 4:00-5:50 p.m.: Sept. 9, 16, 23, 30, Oct. 7, 14, 21. The due date for course portfolio is Thursday, Oct. 28, 2004.

REQUIRED TEXTS

Polya, G. (1945). "How to Solve It," Princeton, NJ: Princeton University Press.

Wankat, P. & Oreovicz, F. (1993). "Teaching Engineering," New York: McGraw-Hill. Out of print; available free on line at:

https://engineering.purdue.edu/ChE/News_and_Events/Publications/teaching_engineering.

BOOKS ON RESERVE

Davis, B.G. (2001). "Tools for Teaching," San Francisco: Jossey-Bass.

Bruner, J. (1960). "The Process of Education," Cambridge, MA: Harvard University Press

OTHER COURSE MATERIALS

Additional course materials will be provided on the Web site <http://www.wolaver.org/teaching>.

GRADING PROCEDURES

Your performance in this course will be graded in three areas: written material, presentations, and classroom participation. The written material is produced throughout the course, but the grade will be based on the compellation in a final portfolio. The presentations include brief lectures and leading discussions. Participation includes contributing to discussions and evaluations. Grades for these activities will be numeric: 0–100. The activities are weighted as follows: 50% for written material, 25% for presentations, and 25% for participation. The numerical course grade will be converted to a letter grade: 90–100 = A; 80–89 =B; 70–79 = C; 60–69 = D; 0–59 = F. We reserve the right to lower these grade cutoffs, but we will not raise them.

ACADEMIC HONESTY POLICY

There are no tests in this course. All written assignments are performed outside of class. You are encouraged to collaborate with colleagues in exchanging ideas about assignments, but the writing itself must be done independently. When making use of external sources such as books, published papers, Web resources, etc., you are expected to cite sources of ideas and information that are not your own, and to enclose in quotation marks and properly attribute any material that you take verbatim from other sources.

COURSE SCHEDULE

All classes 4:00–5:50 p.m. in TBA. Reading assignments are to be done before class. Homework assignments are due the next week.

- 1. Objectives.** Date: 9/9
Topics: What do engineers need to learn? How can teaching help?
In-class practice: One-on-one “tutoring” using 15 “Learning Principles.”
Reading assignment: W&O - Ch.1, 4.
Homework assignment: Prepare topic to present in an 8-minute lecture.
- 2. Interaction.** Date: 9/16
Topics: Lecturing, leading discussions, and tutoring. Leading through questions.
In-class practice: Present prepared lectures.
Reading assignment: W&O - Ch. 6, 10. Polya - Part I.
Homework assignment: Watch Feynman lecture Part 1: Photons – Corpuscles of Light:
<http://www.vega.org.uk/series/lectures/feynman/index.php>
and write up comments on his lecturing techniques.
- 3. Problem Solving.** Date: 9/23
Topics: Encouraging thought habits of discovery, order, simplification, and making connections.
In-class practice: Discuss Feynman lecture; share experiences of discovery, useful analogies, and organizing techniques.
Reading assignment: W&O - Ch. 5. Polya - Parts II, III.
Homework assignment: Prepare an 8-minute lecture using tools from classes 3 & 4.
- 4. Visualization and Intuition.** Date: 9/30
Topics: Using geometry, flow graphs, parametric plots, and mechanical drawings to achieve an intuitive understanding.
In-class practice: Present prepared lectures.
Reading: Wolaver – “Teach Assistant Seminar” <http://www.wolaver.org/teaching/TAseminar.htm>
Homework assignment: Design set of exercises to provide a learning experience.
- 5. Providing Experience.** Date: 10/7
Topics: Designing homework, projects, laboratory.
In-class practice: Perform and evaluate the exercises from homework assignment.
Reading assignment: W&O - Ch. 7, 9, 11.
Homework assignment: Grade the exercise; design a laboratory.
- 6. Evaluation (students & teacher).** Date: 10/14
Topics: Testing, grading, cheating, feedback.
In-class practice: Discussion of testing; evaluation of this course.
Reading assignment: W&O - Ch. 11, 12, 16
Homework assignment: Preliminary design of an engineering course.
- 7.** Date: 10/21
Course Design. Putting it all together—objectives, textbook, lecture topics, sample lecture with visuals, sample homework and test, lab topics, sample lab.
In-class practice: Present preliminary course design.
Reading assignment: W&O - Ch. 3
Homework assignment: Final design of an engineering course (due 10/28).