

# Innovation in Science and Engineering

## Sample Description and Syllabus

*Innovation in Science and Engineering* is being offered to graduate students and advanced undergraduates in the sciences and engineering and others with an interest in technological innovation. Course enrollment is limited to 28 students.

More and more, the forces shaping lives, creating value, and driving change emanate from new knowledge in science and engineering. Where does it all begin? How are important problems found, defined, and solved? What are the roles of teamwork and creativity in the process? And how are the methods scientists and engineers use applied to other fields of endeavor? The course will give you an opportunity to explore these and other related questions through a combination of lectures, case discussions, exercises, and interactions with innovators from science, engineering, and business.

The course will explore the process of innovation and discuss how all aspects of science and engineering are enhanced by it. We will discuss the key steps in all science and engineering, from choosing the best problems, to solving the problem and to presenting the results, and we will show how innovation is critical in all steps. We will also explore teamwork as an essential ingredient in much of modern science and engineering, and, through exercises and projects, we will learn how to be innovative as an individual while still contributing to a team. We will also explore the role of creativity in all aspect of the science and engineering endeavor. The course is open to advanced undergraduates, but is most suited for graduate students involved in research in science and engineering. It is also open to post docs in research groups.

There are no prerequisites for the course, but we require an interest in exploring the factors and conditions that contribute to innovation in science, engineering, and society. As part of the course, students will receive practical and professional training in techniques to define and solve problems, in both individual and team settings.

Week 1	Class 1	Class 2
	<b>In class:</b> <b>Course Introduction</b> – Why is this class important? What are you going to learn? Discussion of goals and objectives of the course, an overview of major themes, requirements and class assignments, expectations, and grading.	<b>In class:</b> <b>Context and Process</b> – Discuss and define creativity and innovation. Describe the complexities of science and engineering. What is the “scientific process”? Pose the questions that they will face and describe how we will address them. How is creativity and innovation applied to science and engineering?
Week 2	Class 1	Class 2
	<b>In class:</b> <b>Problem Selection</b> – A lecture and in-class exercise will focus on the challenges of selecting a problem. The methods of selecting and the values that can be used to assess the problem will be described.  Assign problem selection project.	<b>In class:</b> <b>Problem Selection</b> – Lecture and Exercise to further explore Problem Selection.  Describe project on Problem Selection
Week 3	Class 1	Class 2
	<b>In class:</b> <b>Problem Selection</b> – Group reports and discussion of Problem Selection projects.	<b>In class:</b> Guest Speaker on Problem Selection in Science
Week 4	Class 1	Class 2
	<b>In class:</b> <b>Problem Specification</b> – Once a problem is selected, structure must be placed on the problem prior to moving to a solution phase. This structure will be defined. A description of solution methods of the problem will be begun.	<b>In class:</b> Exercise on Problem Selection and specification.

Week 5	Class 1	Class 2
	<b>In class:</b> <b>Problem Solution</b> – Once a problem is selected and specified, a solution must be developed. This process will be defined. An exercise will be used to practice the process.	<b>In class:</b> <b>First Group Project Meeting</b> – Form the groups for the group project and describe the process. Problems will be selected. Initial group meetings.
Week 6	Class 1	Class 2
	<b>In class:</b> <b>Interviewing and Team Meeting</b> – Introduce the midterm project. Discussion on interview techniques and developing a thesis for the midterm project.	<b>In class:</b> <b>Creative Processes</b> – Describe methods that have been used and well developed to create innovative solutions to problems.
Week 7	Class 1	Class 2
	<b>In class:</b> <b>Creative Processes</b> – Describe how teams function while maximizing their creativity.	<b>In class:</b> Guest Speaker to describe their perspective on innovation.
Week 8	Class 1	Class 2
	<b>In Class:</b> Team Meeting  Each group will attend a half day session during next two weeks to do problem solving with their projects and to develop methods to effectively work as an innovative team.	<b>In Class:</b> Review of progress to date and special topic on Innovation in Science and Engineering.  Case Study. Come prepared.
Week 9	Class 1	Class 2
	<b>In class:</b> How does innovation in research occur? Describe model of research and how problem selection and solution methods can impact results.	<b>In class:</b> <b>Creativity in Science</b> – Discuss how scientists are creative. Develop and discuss model for determining how solutions develop. What does it mean to us?
Week 10	Class 1	Class 2
	<b>In class:</b> <b>Innovation in Industry</b> – Two speakers will join the class to discuss their perspective on innovation in small and medium companies.	<b>In class:</b> Team Meetings
Week 11	Class 1	Class 2
	<b>In class:</b> <b>Sell and Create Value</b> – Being able to “sell” your innovation is critical to success. Discuss how to influence the thoughts or behaviors of others. Plan for action is based on your desired impact.	<b>In class:</b> Case study. Come prepared
Week 13	Class 1	Class 2
	<b>In class:</b> Continue case study.	<b>In class</b> – Guest speaker to describe his perspective on innovation and education in the world of science.
Week 14	Class 1	
	<b>In class:</b> Group Project Presentations Final Reports Due	