1. ES503 Advanced Technologies

2. 3 credit hours, 3 recitation hours, 0 laboratory hours

3. Course coordinator: Professor Bradley E. Bishop

4. No textbooks are required for this course

5. Specific course information

a. This course provides students with background and insight into the implications of emerging technologies, focusing on the impact of these technologies from a global, societal perspective. Students use fundamental scientific and engineering skills to analyze state-of-the-art technologies and predict directions of future expansion and application of these systems. Sample topics include nanotechnology, cybernetics, genetic engineering, intelligent highway vehicle systems, etc.

b. Prerequisite: 1/C ESEH major

c. Required course for the Honors Systems Engineering major

6. Specific goals for the course

a. At the conclusion of the course, students will be able to:

- Articulate the importance and impact of forward thinking in technology matters.
- Follow the methodology for sound projection of emerging technologies.
- Apply rigorous socio-technological analysis tools to novel technologies.
- Understand the science, state-of-the-art, and long-term implications of a variety of important emerging technologies.
- Understand the roles of money, society and politics in technological development.
- Tie projection and prediction of advanced technologies to life at the USNA and the military service.

b. This course focuses on an understanding of the societal impacts of new technologies and methods by which emerging concepts can be analyzed, predicted, and (insofar as possible) managed. As such, it addresses the following outcomes:

- (a) an ability to apply knowledge of mathematics, science, and engineering

- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues

7. Topics covered:
    - Principles of technology projection, prediction, and valuation
    - Sociotechnological analysis tools, such as Sager's Technology Integration Coordinates and MacKenzie's Uncertainty Trough as well as the Gartner Hype Cycle
    - Technology development models such as Christenson's Disruptive Innovation model, Moore's Crossing the Chasm, and Coburn's Change Function
    - Case studies on historical innovations, including Mitchell's introduction of air power to the military, the sociotechnological development of the bicycle, and early predictions about the American mass transit system as compared to the reality
    - Currently relevant case studies. Recent topics have included autonomous cars, gene therapy (especially as enabled by CRISPR-Cas9), blockchain and crypto-currency, nootropics, etc.
    - The use of science fiction to motivate analysis of technology development.
    - Student-driven analysis of modern technology and future developments based on a science fiction novel
    - Emergent topics identified during the semester