Introduction

This proposal is a minor revision of the proposal from Electrical Engineering and Materials Engineering for SJSU Studies areas S and V. We propose that the two one-unit seminars Engr 195a and b along with our senior project sequence ME 195a and b be used to satisfy S and V when taken together. Engr 195a and b have learning activities and assignments related to each S and V learning objective. Learning activities and assignments in ME 195a and b will be used to show students how these important issues relate to the everyday work they will be doing as engineers.

Overview of ME 195a/b

ME 195a/b is a year-long senior project sequence that models what many students will be doing upon graduation. They must come up with project objectives and specifications, go through the entire design process, and build and test their prototypes. Students are required to integrate the knowledge gained before the senior year into the development and analysis of their designs. Students work on teams of typically 3-6 students, and each team has a different project which may come from their own interest, a national competition, industry, or faculty research or development.

Four sections of this course are regularly offered, and the class meets Wed 1:30-4:15. The four sections meet together for the first meeting of each semester for an introductory/overview meeting. In addition, two seminars on topics of interest to all sections are scheduled during each semester. Three meetings each semester are used for team presentations. The remaining sessions are project work sessions, in which each instructor typically meets with each team to discuss progress and assist them with problems.

All instructors are full-time tenured faculty members in Mechanical Engineering with Ph.D’s in the field.

Integration of ME 195a/b assignments with Engr 195a/b

Throughout the Mechanical Engineering curriculum students have assignments in which they must examine the global and/or societal impact of their work. For example,

- In ME 113 Thermodynamics students write an advocacy memo to a politician indicating whether or not they support the president’s new Corporate Average Fuel Economy (CAFÉ) Standards. They must examine the life-cycle environmental impact as well as cultural, social, and economic implications.

- In ME 111 Fluid Mechanics students write a research paper where they examine a current event or technological device related to fluid mechanics and how it impacts society.

- In the capstone design courses (extra in-depth design courses taken with the first semester of their senior design projects), students have a week-long module on engineering ethics.

Despite these kinds of assignments, students frequently have a hard time seeing how the everyday work that they will be doing as engineers directly impacts society and the world and how cultural and societal
norms impact their designs. It is the goal of these new additions to ME 195a/b to help develop this understanding.

In a few senior design projects, it is relatively easy for students to make this connection. For example, one senior project team this year is developing a solar cooker that cooks at night. In their reports, students discuss how previous solar cookers failed because they required individuals to cook during the heat of the day—a requirement which didn’t match the people’s lifestyles for the region. They also discuss how implementation of their project would reduce deforestation and allow more educational opportunities for girls, since they would no longer need to spend 6-8 hours per day collecting scarce firewood.

In many projects, students will have the think more deeply. What are the global and societal implications of a car designed for the Society of Automotive Engineers competition? Or what about a new type of device that a team is developing to cool electronics for a Lockheed Martin satellite? Or a robot developed to assemble components of a catheter for a biomedical company? Many students will be working on these kinds of projects upon graduation, and the experience students get thinking about the broader impacts of their work can be invaluable.

As a result, the goal of the assignments in ME 195a and b will be to help students think in depth about how their work as engineers affects and is affected by society and the world, and they will be using their senior design projects as a year-long case study. The S/V assignments will all directly relate to the students’ projects. As they progress in their projects, they will be able to use what they learn in Engr 195a/b to help them develop a deeper understanding of how these issues affect the practical development of their designs. It is our hope that students will carry this greater perspective with them to their jobs after graduation.

The following assignments and seminars will be used to help students grow in their understanding throughout the course. Each assignment builds upon the previous one to help students delve deeply. The fall semester focuses more on GE Area S learning objectives and the spring on V, to match Engr 195a/b. All S and V learning objectives are met in Engr 195a and b. These assignments will help students see how those learning objectives affect the work that they will be doing as engineers.

ME 195a Seminar: Impact of Technology on Society

This seminar will be placed in the fourth week of ME 195a, after the teams have decided upon their projects. The goal of this seminar will be to help students start thinking broadly about how societal norms affect their design and how their work as engineers affects society. Senior design projects from previous years will be used as case studies to encourage students to start thinking about these issues. The issues will largely focus on learning objectives related to GE area S to coincide with the learning the students are doing in Engr 195a.

ME 195a Assignment 1(Individual)

In this individual assignment, students write a paper right after attending the seminar discussed above, to be due in the sixth week of class. In this paper, students are asked to address how their projects may affect society (locally and/or globally) if implemented and how human behavior will affect the success of their designs. The complete assignment is shown in the appendix of the report.
It is expected that many students will show a relatively unsophisticated understanding of these issues in this first assignment, and detailed feedback will be provided by the instructors. A minimum of 600 words will be required. Each subsequent assignment needs to show greater sophistication and hence a longer analysis.

**ME 195a Team Discussions**

Two weeks after the individual assignment is due, instructors will hold meetings with each team of students (typically 20 minutes per team of 3-6 students) and lead a discussion on their writing assignments. The goal of this meeting is for the instructor to help spur the students to think more broadly about the social and cultural impact of their projects.

**ME 195a Assignment 2 (Team)**

This second assignment comes at the end of ME 195a, when the students are nearing completion of Engr 195a. Each team of students is required to discuss the feedback from their first assignment and team meeting with the instructor as well as what they learned in Engr 195a and use that to rework the first assignment. The team discussion should help students develop a more thorough analysis. This written assignment will become part of Chapter 1 of their major team project report that is due at the end of the semester. This chapter focuses on the motivation for their project, a state-of-the-art review, its significance, and an overview of team dynamics.

**ME 195b Assignment 1 (Individual)**

This individual assignment is given in the fifth or sixth week of ME 195b. Again, the goal of this assignment is to encourage the students to develop a more sophisticated understanding of the societal and global issues surrounding their project. They must add elements related to GE area V learning objectives, since those are mostly covered in Engr 195b, which they take concurrently. The assignment is shown in the appendix.

**ME 195b Seminars**

To help students see the big picture of how their work relates to GE Area V learning objectives, two hour-long seminars and two quizzes related to these issues are also included. These largely relate to GE Area V SLO #3. The topics are shown below.

Presentation 1: On Global Economy and Social Impacts– This presentation broadly examines changes in the global economic landscape since the 1980’s and the social and economic impact of those changes. (Week 5)

Presentation 2: Energy, Environment and Global Impacts (or similar, depending on the semester)– This presentation examines the global environmental and political impact of issues related to power generation (relates more to R, but does have application to Area V SLO #3 as well). (Week 14)
ME 195b Assignment 2 (Team)

Students must discuss the feedback from their instructor about their first ME 195b assignment and what they have learned in Engr 195b to bring their first analysis to a more sophisticated level. This group assignment becomes part of the group project report submitted in May, at the end of their projects.

Assessment

A rubric will be used to assess each writing assignment (Most instructors will use Canvas, but this will not be required.). The rubric will be uniform across all four sections to ensure similar standards. Both average grades and the percentage of students receiving unacceptable scores will be calculated. Since a C- or better is required in these classes for graduation, the minimum acceptable grade will be a C-.

The four instructors for ME 195a and b already use a detailed uniform rubric to assess the major report due at the end of each semester. Adding these new elements will only require a modification of the existing rubric for the second assignment for both ME 195a and b.

Quiz grades (related to the two seminars in ME 195b) will also be used for assessment, although the quizzes do not go in as high a level on Bloom’s taxonomy as the writing assignments. The writing assignments will be a better gauge of student achievement of the learning outcomes.

Writing Requirements

ME/Engr 195a minimum words written comes to 3100 individual plus and addition 600 words as a team revision for area S.

ME/Engr 195b minimum words written comes to 3400 individual plus an additional 900 words as a team revision for area V.

(In addition, students write a technical team report in ME 195a and b. Typical lengths in ME 195a are 50-100 pages and 75-150 for ME 195b, including figures, schematics, and graphs.)

Summary

The goal of the ME 195 S/V assignments is not to introduce more topics related to S and V learning objectives since these are covered in Engr 195. Rather, these assignments all directly relate to the students’ projects to help them develop an understanding that whatever work they choose after graduation, their success is influenced by global and societal affects, and their work also will have an important effect on society and the world.

For further information or clarification of any issues, please contact Nicole Okamoto, Associate Chair of Mechanical Engineering (Nicole.okamoto@sjsu.edu, x44054).
Appendix A – ME 195a and b Assignments

ME 195a Assignment 1 (Individual)

In Engr 195a and b you will be addressing issues related to self, society, and equality in the United States (SJSU Studies area S) and culture, civilization, and global understanding (SJSU Studies area V). In your senior project classes, we want you to examine how these issues relate to the work you do as engineers.

In this assignment, address how your project may affect society--locally and/or globally--if implemented and how human behavior will affect the success of your design.

The following are a list of questions to help you start thinking about this analysis. Not all questions will apply to all projects, and this list is not necessarily comprehensive.

- What global, social or cultural influences have led to a need for your project?
- If implemented on a wide scale, how will your project result in greater equality and social justice?
- How will your design help create an even playing field for underprivileged people?
- What human, social, and cultural barriers may result in difficulties implementing your project?
- How may society’s perception of your project result in difficulties during implementation?
- What may be the environmental impact of your project over its life cycle?
- What may be the effect on public health or society? How will your project affect quality of life?

If you are developing a component that will be used within a larger system, you are welcome to relate these questions to the design and use of the larger system, rather than the individual component that you are designing. Some of these questions cannot be addressed fully until you have a final design. In your second semester you will be asked to address these topics again so that you can do a more complete analysis, informed by your final design.

You need to write enough to do a thorough job, but the minimum requirement is 600 words (approx. two pages double-spaced).

ME 195a Assignment 2 (Team)

As a team, discuss the feedback from your first assignment as well as what you learned in Engr 195a. Use that to rework the first assignment. This group written assignment will become Chapter 1 part d of your major project report that is due at the end of the semester. The outline of that report is shown below.

1. Title Page
2. Chapter 1 Introduction
   a. Motivation of the project (or needs)
      e.g., market needs, community needs, new technology needs, automation needs, energy saving needs, environmental protection needs.
b. Current status (literature review)
   - How other people solve this problem in the past or currently
   - Which technologies they used
   - What kinds of results they have achieved
   - What issues or disadvantages of their methods

c. Project objectives and specifications
   - How would you tackle the problem differently from the existing methods
   - Which technologies or principles or methodologies you are proposing?
   - What specifications and results to be expected (e.g., including materials you choose, geometry, accuracy, speed, weight, capacity, constrains)

d. Global and societal implications of your project (GE S/V writing assignment #2)

e. Team work
   - Indicate the responsibility of each team member on the project
   - How does he/she conduct the task(s)/project.

f. Gantt Chart

3. Chapter 2 Theoretical Background
4. Chapter 3 Prototype Design
5. Chapter 4 Microcontrollers and Electronic System Interface (if applicable)
6. References
7. Appendices

ME 195b Assignment 1 (Individual)

In ME 195a, you addressed how your project may affect society--locally and/or globally--if implemented and how human behavior will affect the success of your design.

Expand upon that assignment, using what you learned in Engr 195a/b to do a more comprehensive analysis. Now that you have a final design, you will also be able to address some of the questions more fully (such as the environmental impact). In addition, add a new section discussing the following elements, as they apply to your project:

- How would you recommend changing your design, if at all, if your project were to be implemented in a country with a distinctly different culture than in the United States? For example, if you implemented your design in China, would the different social and cultural norms necessitate changes to the final design? Feel free to address only one culture as an example.

- What human, social, and cultural barriers may result in difficulties implementing your project in a country outside of the United States? Feel free to address only one culture as an example.

- In what ways may your project malfunction to harm public health?

- In what ways could your project harm public health or society, even if used properly?

- In what ways could your project be mis-used in such a way to harm someone’s health?
ME 195b, Assignment 2 (Team)

As a team, discuss the feedback from your first ME 195b assignment as well as what you learned in Engr 195b. Use that to improve and expand upon the first ME 195b assignment. The new elements of ME 195b should be incorporated into sections 5d and 11d and e of your final report for the year. The outline of the report is shown below with these elements in bold.

Final Report Outline

1. Title Page
2. Abstract
3. Acknowledgement
4. Tables of Contents
5. Chapter 1 Introduction
   a. Motivation of the project (or needs)
      e.g., market needs, community needs, new technology needs, automation needs, energy saving needs, environmental protection needs.
   b. Current status (literature review)
      ▪ How other people solve this problem in the past or currently
      ▪ Which technologies they used
      ▪ What kinds of results they have achieved
      ▪ What issues or disadvantages of their methods
      Please don’t forget to put the reference/source when listing each work
   c. Project objectives and specifications
      ▪ How would you tackle the problem differently from the existing methods
      ▪ Which technologies or principles or methodologies you are proposing?
      ▪ What specifications and results to be expected (e.g., including materials you choose, geometry, accuracy, speed, weight, capacity, constrains)
   d. Global and societal implications of your project (GE S/V writing assignment part a)
   e. Team work
      ▪ Indicate the responsibility of each team member on the project
      ▪ How does he/she conduct the task(s)/project.
      It would be ideal to have a multi-disciplinary team (e.g., the first member is in design, the second member is in mechatronics, and the third one is in thermal and fluid area).
   f. Gantt Chart
6. Chapter 2 Theoretical Background
7. Chapter 3 Prototype Design
8. Chapter 4 Microcontrollers and Electronic System Interface (if applicable)
9. Chapter 5 Fabrication and Assembly
10. Chapter 6 Testing Results and Analyses
11. Chapter 7 Conclusions and Future Work
   a. Draw conclusions from your design, calculations, simulations, and experimental results. How well does your project meet the original specifications?
b. Draw conclusions from your team work—how well did your team work together, and what did you learn about teamwork this year

c. Draw conclusions from cost analyses

d. Discuss how would you recommend changing your design, if at all, if your project were to be implemented in a country with a distinctly different culture than in the United States and any human, social, and cultural barriers may result in difficulties implementing your project in a country outside of the United States. (from GE Writing Assignment #2)

e. Discuss how your project may affect public health or safety (from GE Writing Assignment #2)
   i. In what ways may your project malfunction to harm public health?
   ii. In what ways could your project harm public health or society, even if used properly?
   iii. In what ways could your project be mis-used in such a way to harm someone’s health?

f. Discuss future improvements that could be made to the project.

12. References

13. Appendices