Industrial and Systems Engineering Proposal for SJSU Studies Areas S and V

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 ISE 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 ISE 195a and b will be used to show students how these important issues relate to the everyday work they will be doing as engineers by researching similar subjects in our professional magazine Industrial Engineering and thru integration of their senior design project.

Overview of ISE 195a/b

ISE 195a/b is a year-long senior project sequence that models what many students will be doing upon graduation. They must come up with real-world project for process and quality improvement integrating their knowledge from their ISE curriculum. 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 3-4 students, and each team has a different project which must come from a real-world organization. Each course is offered every semester, and the classed meet on Fridays. In addition, the instructor meets with each team to discuss progress and assist them with problems. The students at these weekly meetings are required to make a formal presentation of their progress. All instructors are full-time tenured faculty members in Industrial and Systems Engineering with Ph.D’s in the field. The final report guideline for the senior design project is shown on Appendix C. Please note this is just a suggested guideline as not all steps will be appropriate due to the nature of the students project.

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

This section addresses how ISE 195 a/b will be integrated with Engr 195 a/b in order for ISE majors to have a better understanding and awareness of culture, societal, and global implications on their careers and lives upon graduation. As a result, the goal of the S/V assignments in ISE 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. It is our hope that students will carry this greater perspective with them to their jobs after graduation.

The discussion below explains how the students will develop and grow their understanding on S/V objectives throughout these courses. ISE 195a focuses more on GE Area S learning objectives and ISE 195b 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. It should also be noted that even though ISE 195 a/b are taught by ISE faculty, Engr 195 a/b will be taught by highly qualified and trained general education instructors.

ISE 195a requires the students not only to define their project but to research modern industrial engineering problems and solutions thru the professional societies, Institute of Industrial Engineers, magazine. This magazine contains numerous articles that address the role and impact of the industrial engineering profession on culture and society at large in the US and globally. Specifically, the students will research articles that address the following S learning objectives in ISE 195a:
S-LO1: describe how identities (i.e. religious, gender, ethnic, racial, class, sexual orientation, disability, and/or age) are shaped by cultural and societal influences within contexts of equality and inequality;

- ISE 195A Paper: An article from the designated Industrial Engineer magazine that focuses on identities being shaped by a country’s culture, outside influences, relationships with the U.S., and the history based on cultural inputs. After reading the article, the student will summarize and add personal connections and experiences to the article, analyzing views from the American side as well as another. (500 words).

S-LO2: recognize and appreciate constructive interactions between people from different cultural, racial, and ethnic groups within the U.S.

- ISE 195A Paper: An article from the designated Industrial Engineer magazine that focuses on identities being shaped by a country’s culture, outside influences, relationships with on constructive interactions between different cultures. After reading the article, the student will summarize and add personal connections and experiences to the article, analyzing views from the American side as well as another. (500 words).

A sample of some articles that appeared in the Industrial Engineering magazine that can address these learning objectives is as follows: Transforming India: A supply chain task (Global Supply Chain- India) and Outsourcing Revisited (history and benefits). Appendix A shows the weekly plan of how these topics are integrated into ISE 195a.

The majority of the students senior design project is performed and completed in ISE 195 b. Hence, the students will be required to write a paper addressing the human, social, and cultural barriers that may result in difficulties implementing their project in a country outside of the United States (minimum 1500 words). To assist them with this assignment, they will be first required to again research an article in the Industrial Engineering magazine that compares strategies and ideas from other countries outside of the US in regards to their economic structures, technological developments, and/or attitudes (500 words). For example, the following articles have been identified for this assignment:

1. It’s Not Just Luck for the Irish (Lean improvements- Ireland)
   - Economy has been growing since 2012
   - Lean started in Japan now it is used worldwide
2. Euromatics: Economic Challenges and Opportunities (interconnectivity)
   - Not just Europe’s problem, the world’s problem
   - Europe accounts for a large portion of different metrics for the world
3. Advancing Facility Planning (Lack of Layout Skills in Asia)
   - Global manufacturing has moved to Asia
   - Lack of facility planning/ layout skills in workers
   - Disconnect between new techniques and what schools are teaching
4. The Synergy of a Cluster (Automotive Sector- Mexico)
   - Mexico has an automotive cluster
   - Clusters help nearby areas be connected and compete with each other

These assignments are design the meet the following Area V learning objective: compare systematically the ideas, values, images, cultural artifacts, economic structures, technological developments, and/or attitudes of people from more than one culture outside the U.S.
Appendix B also shows a plan of how these assignments are integrated into ISE 195b. Also, the students are required to attend a symposium sponsored by the College of Engineering to meet the following V learning objective. Explain how a culture outside the U.S. has changed in response to internal and external pressures. The students are required to summarize the symposium in group discussion and presentation (5-10 minutes).

Assessment

A rubric will be used to assess each writing assignment (Most instructors will use Canvas, but this will not be required.). 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 instructor for ISE 195a and b already uses a detailed uniform rubric to assess the major report due at the end of each semester. Adding these new elements will only require modifications to the existing rubrics.

Writing Requirements

ISE/Engr 195a minimum words written comes to 3500 for area S.

ISE/Engr 195b minimum words written comes to 4500 for area V.

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

Summary

The goal of the ISE 195 S/V assignments is to support the topics related to S and V learning objectives covered in Engr 195. These assignments all directly relate to the students’ 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 Yasser Dessouky, Chair of Industrial and Systems Engineering (yasser.dessouky@sjsu.edu, x44133).
Appendix A: ISE 195A Course Plan for Area S integration

Homework 1:
*IE Article 1 Individual Analysis
  - Each student will choose 1 article from the designated Industrial Engineer magazine articles
  - Articles focus on identities being shaped by a country’s culture, outside influences, relationships with the U.S., and the history based on cultural inputs
  - After reading the article, the student will summarize and add personal connections and experiences to the article, analyzing views from the American side as well as another country’s view
  - Due: 2-page, double-spaced, technical paper of analysis of the article

Class Plan- Week 2:
IE Article 1 Discussion
  - Present Area S questions list to class and individual article questions
  - Small group discussion of article; highlighting questions on the list
  - Each group will consist of students who all read different articles to summarize and analyze for 5-10 minutes per speaker

Homework 2:
*IE Article 1 Individual Analysis
  - Each student will summarize Area S questions list as discussed in groups
  - Due: 1- page, double-spaced, technical paper of answers to questions relating to Article 1

Class Plan- Week 3:
Code of Ethics; Article 2 for Group Presentation
  - Introduce Engineering Code of Ethics
  - Choose 2nd Article for group presentation with focus on ethics
  - Discuss Article 2 in new groups

Homework 3:
*IE Article 2 Individual Analysis
  - Each student will summarize and analyze Article 2
  - Due: notes to use in group discussion (IE topics, Area S questions, Ethics of Article 2)

Class Plan- Week 4:
  - Review of ethics cases (videos and NSPE Board of Ethical Review)
  - Discuss Article 2 in new groups: focus on presentation topics

Homework 4:
Draft Presentation
  - Slide presentation focusing on IE topics, Area S questions and ethics
  - 10-15 min presentation per group

Class Plan- Week 5:
Draft Presentation
  - Group meeting of draft presentation with 3 focus areas
  - 10-15 min presentation per group

Homework 5:
Article 2 Presentation
- Finalize group presentation of Article 2

Class Plan- Week 6:
Group Presentations
- 10-15 min presentation per group
- Teamwork/ Group Participation Evaluations

Homework 6:
Individual Ethics Analysis
- Choose a case from NSPE- BER
- Due: 2-page, double-space, technical paper summarizing case’s ethical issues, discussing referenced codes, codes not mentioned (but relevant), and personal interpretation of ruling

Class Plan- Week 7:
Data Analysis Projects
- Choose data analysis project and groups
- Discuss ethics analysis assignment in new groups
- Plan and schedule first site visit

Homework 7:
Site Meeting Review
- Short report on first site meeting (area of focus, goals, and timeline)
- Start a running list of answers to Area S questions in terms of new project

Class Plan- Week 8:
Initial Findings Report
- Review report on first site meeting (area of focus, goals, and timeline)
- Review answers to Area S questions list

Homework- Project Update:
- Summarize meeting notes
- Report on project data analysis (using technical writing and IE techniques)

Class work- Project Update:
- Individual group meetings to presenting findings for project
*Area S Assignments:*

**Summary of Relevant IE Magazine Articles**  
(A list of specific questions for each article is prepared)

1. Transforming India: A supply chain task (Global Supply Chain- India)  
   - Origin of supply chain  
   - How a country can grow and become a key part of a global supply chain
2. The Generations of Improvement (history of IE)  
   - History of IE (1st to 2nd to next generation)  
   - Lessons learned and future planning
3. Outsourcing Revisited (history and benefits)  
   - Original goals and history  
   - Improvement opportunities
Appendix B: ISE 195B Course Plan for Area V integration

Homework 1:
*IE Article 1 Individual Analysis
- Each student will choose 1 article from the designated Industrial Engineer magazine articles
- Articles focus on technological development outside the US, historical and cultural change from other countries that have influenced the US, and the US shaping another country’s culture
- After reading the article, the student will summarize and add personal connections and experiences to the article, analyzing views from the American side as well as the other country’s view
- Due: 2-page, double-spaced, technical paper of analysis of the article

Class Plan- Week 2:
IE Article 1 Discussion
- Present Area V questions list to class and individual article questions
- Small group discussion of article; highlighting questions on the list
- Each group will consist of students who all read different articles to summarize and analyze for 5-10 minutes per speaker

Homework 2:
Site Meeting Review
- Short report on first site meeting (area of focus, goals, and timeline)
- Start a running list of answers to Area V questions in terms of project

Class work- Project Update:
- Individual group meetings to presenting findings for project
- Review running list of answers to Area V questions in terms of project

Homework- Project Update:
- Summarize meeting notes
- Report on project data analysis (using technical writing and IE techniques)

*Area V Assignments:

Summary of Relevant IE Magazine Articles
(A list of specific questions for each article is prepared)

5. It’s Not Just Luck for the Irish (Lean improvements- Ireland)
   - Economy has been growing since 2012
   - Lean started in Japan now it is used worldwide
6. Euromatics: Economic Challenges and Opportunities (interconnectivity)
   - Not just Europe’s problem, the world’s problem
   - Europe accounts for a large portion of different metrics for the world
7. Advancing Facility Planning (Lack of Layout Skills in Asia)
   - Global manufacturing has moved to Asia
   - Lack of facility planning/ layout skills in workers
   - Disconnect between new techniques and what schools are teaching
8. The Synergy of a Cluster (Automotive Sector- Mexico)
   - Mexico has an automotive cluster
   - Clusters help nearby areas be connected and compete with each other
Appendix C: GUIDELINE CHECK LIST TO EVALUATE PROJECT REPORT
(Not all sections must be included use only as guideline as appropriate to your project)

TABLE OF CONTENTS (required)
TABLE OF FIGURES (required)
TABLE OF TABLES (required)
EXECUTIVE SUMMARY (required)
   D-One page summary to the executive board members including mission, vision, goals, objectives, and critical success factors

1.0 MARKET RESEARCH
1.1 Current Products Review (for three competing products and your own)
   D-Highlights of current products
   T- Comparison of different products with their features, and prices

1.2 Manufacturers Profiles (for three competing products and your own)
   D-Company highlights
   T- For each company, lists its name, address, employee numbers, description of business, strengths and weaknesses, and financial summary over past 3-5 years
   F- Summary of current shares of the industry
   F- Summary of proposed market share of your company

1.3 Customer Values Assessment
   D-Principles, procedure, advantages of procedure
   D-Market survey methods and procedures (group must conduct survey)
   T- Customer survey results
   F- Customer attribute Pareto chart
   F- Relationship of the houses in the QFD process (handout)
   F- House of Quality for engineering characteristics
   F- House of Quality for parts characteristics
   F- House of Quality for process planning
   F- House of Quality for process control

1.4 Functional Description
   D-Unique functions of individual products
   F- Key functions of your product
   T- Comparison with products from other manufacturers on key functions

1.5 Technology Trends (for the product class)
   D-Summary of key product features
   D-Trends of functions, costs, quality, delivery, and service
   T-Weight, dimensions, interfaces, power ranges and requirements, environmental range, etc.
   F- Trends of key product features
   F-Technology and market progress over time

2.0 PRODUCT DESCRIPTION
2.1 Product Drawings
   D-Summary
   F- Drawings (photos OK) of finished product (level 0 on BOM)
   F- Drawings (CAD drawings) of sub-assemblies (level 1 on BOM)
   F- Drawings (CAD drawings) of other key components
   F- Drawings (CAD drawings) assembly drawing of product

2.2 Bill of Materials
   D - Summary
   F - Multilevel tree structure (including options and features)
2.3 Materials, Suppliers, and Supply Chain
T- Supplier selection criteria
T- Assessment of supplier capability
T- Value chain analysis
F- Supply chain management
T- Material sources: BOM vs. vendor
T- Planning BOM in matrix format: part vs. description, U/M, and models

3.0 BUSINESS PLAN
3.1 Product/Process Life Cycle
   D-Forecasting methodologies and assumptions
   T- Forecasting calculations
   F- Life cycles for individual product: volumes (or revenue) vs. time

3.2 Cost/Pricing/Volume/Profit
   D-Summary, assumptions and equations
   T- For individual product: volume, unit price, unit cost, and gross profit vs. time

3.3 Financial Statements (for your product)
   D-Summary, assumptions, procedure
   T- Pro forma income statement for each quarter
   T- Pro forma balance sheet for each quarter
   T- Pro forma cash flow statement for each quarter

4.0 PROCESS DESIGN
4.1 Methods and Technologies
   D-Product position strategy (make-to-stock, assemble-to-order, make-to order) Process position strategy (flow shop, job shop, fixed site) Technology choices (EDI, CAD, CAPP, CAS&MP, CAM, CAI, GT, FMS) Operations planning and control methods (MRP, ROP, JIT, CFM, TOC)
   T-Manufacturing strategy for each year (market characteristics, manufacturing task, manufacturing features, master production schedule, detailed material planning, shop-floor systems)

4.2 Routing/Operations Sheets
   D- Summary
   F- Assembly Charts
   F- Assembly charts for scheduling production
   F- Operation process chart
   F- Production routing sheet

4.3 Production Capacity
   D-Assumptions, input variables, summary
   D-Line balancing, definitions of lead-time, cycle-time, yield, and throughput
   T- Production requirements from forecasting
   T- Required production capacity for each work center (Rough cut plan)

4.4 Process Flow
   D-Summary
   F- Flow Chart of Overall Process
   F- Work Place Diagram (CAD Drawing) Work Flow Diagram
   F- Material Flow Process Chart for major operations
   F- Material Flow Process Chart for rework operations
   F- Material Flow Process Chart for sub-assemblies
5.0 PRODUCTION RESOURCES

5.1 Machines and Equipment (Production/MFG only, no Material Handling)
   D-Equipment grouped in areas, assumptions for life cycle economic evaluation
   T-Life cycle economic evaluation: alternatives vs. costs (operation, maintenance, etc.)
   T-Life cycle economic evaluation: alternatives vs. net present values
   T-Capital expenditures over time: equipment vs. quantity, cost
   T- Depreciation of machines and equipment
   T- Computers and controllers (PCs, PLCs CNC/NC controls)

5.2 Labor Requirement (Linear Programming solution)
   D- Linear program formulation and results, sources of cost data, assumptions in cost data tables,
   T- Input cost data: Demand Forecast per quarter, Cost of Hiring an Employee,
   Cost of Firing an Employee, Cost of labor for regular time, Cost of Labor for Overtime,
   Cost of Labor for Idle time, Cost per hour of Carrying Inventory per period,
   Cost per hour of a unit of backorder per period,
   T - Initial inventory level, initial number of employees, Total number of regular hours available
   per quarter.
   F - Math formulation of aggregate production planning problem for Q1,
   D - Results of solving aggregate problem formulation for Quarters 1-4 of the first year
   T- Production Plan for first 4 quarters to meet forecasted demand that minimizes
   total inventory holding and backorder costs, Total cost of your production plan for each quarter,
   production quantity per quarter, ending inventory Per quarter, number of units backordered each
   quarter.
   T- Values of all variables in the formulated problem for Quarters: 1-4.

5.3 Material Handling – Mfg (conveyers, carts, trolleys, roller-rack/bin systems)
   T- Machine to Machine Material Handling Table
   D-Equipment grouped in areas, assumptions for life cycle economic evaluation
   T-Life cycle economic evaluation: alternatives vs. costs (operation, maintenance, etc.)
   T-Life cycle economic evaluation: alternatives vs. net present values
   T-Capital expenditures over time: equipment vs. quantity, cost
   T- Depreciation of material handling equipment

6.0 FACILITY DESIGN

6.1 Facilities and Plant Layout
   D-Decision procedure, assumptions, justifications
   T- Production area space requirements
   T- Office space requirements
   T- Facility space requirements
   T- Relationship chart priority codes
   T- Activity Relationship chart
   T- Value chart
   F- Nodal diagram
   T- Block calculations
   F- Block diagram of layout (CAD diagram)
   F- Plant layout: production area layout (CAD diagram)
   F- Plant layout: plant site layout (CAD diagram)

6.2 Material Handling – Overall Facilities (lift trucks, conveyer, hand trucks, etc.)
   D-Equipment grouped in areas, assumptions for life cycle economic evaluation
   T-Life cycle economic evaluation: alternatives vs. costs (operation, maintenance, etc.)
   T-Life cycle economic evaluation: alternatives vs. net present values
   T-Capital expenditures over time: equipment vs. quantity, cost
6.3 Inbound Storage and Warehousing
D-Storage policy, functions, location, size, staffing, operations, and performance
F- Material Flow Chart
D- Floor-space Determination
F- Storage and warehouse layout
F- Flow diagram of material through storage and warehouse

7.0 MANAGEMENT PLANNING
7.1 System Simulation
D- Modeling objectives, Input variables, Assumptions, formation, explanation of model outputs, validation methodology
T- Work center reliability – mean of exponentially distributed time between failures, mean of exponentially distributed repair time for each work center
T- Product processing time at each work center
T- Standard deviation of product processing times
T- Travel time to/from each work station
T- Routings of the product
T- Setup times at each work center – min per lot
T – Output results: manufacturing cycle time, Throughput, total cost
T – Validation results
T - WIP, utilization
F – Simulation model layout

7.1A Design of Experiment
D – DOE objectives and approach
T – Experimental design (vary 3 input variables at 2 levels – Response variable selected from Output result list above)
T – Results of DOE analysis

7.2 Financial Analysis
D-Summary and Equations
T- Loan amortization schedule
T- Depreciation schedule
F- Learning curve effects: variable costs vs. time (Engr Econ p53-54)
T- Ratio analysis: ratios (ROI, IRR, ROA) vs. time (Engr. Econ Analysis)
F. Break-even-point analysis: revenue and cost vs. volume

7.3 Computer Information System
D-Applications: CAD/CAM, MRP, AP/AR/GL/PR
D-Planning, analysis, design, implementation, and support phases
F-Data modeling: entity relationship diagrams
F-Process modeling: data flow diagrams
F-Network modeling: connectivity diagrams
T- Hardware and software configurations

7.4 Quality Assurance
D-Principles and implementation plan of TQM
D-Quality assurance plan with SPC, process capability and design of experiments D-Plan for ISO 9000 registration
D-Quality assurance manual including supplier relations, manufacture, inspection, test, measurement, field performance, and customer service

7.5 Manpower and Organization
D-Management philosophy, corporation culture, and organization styles
7.6 Implementation Schedule
    D-Decision procedure, assumptions, justifications
    F- Start-up implementation schedule - Gantt, CPM/PERT charts

REFERENCES
    D-Textbooks, articles, company reports, Internet home pages

APPENDICES
    T- Detailed tables
    F- Detailed figures