Online Employer Survey Form
C.1 Online Employer Survey Form

Improving the Industrial and Systems Engineering (ISE) Undergraduate Education at San Jose State University

Survey

ABOUT YOURSELF AND YOUR ORGANIZATION

Name

Job Function

Company Industry

The following statements are the ISE program objectives. These objectives state the abilities that ISE graduates are expected to demonstrate 3 to 5 years after graduation.

Please rate how important each program objective is, for ISE graduates in your view. Select one rating for each objective on the 1-5 scale where (1) is "Not Important" and (5) is "Extremely Important" (Select the appropriate choice)

The objectives of the ISE program are to educate Industrial & Systems Engineers who are able to:

1. **Function effectively as an ISE professional in any industry, government, or service organization designing, improving and implementing efficient business processes.**

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2. 

3. **Use methodologies and computational skills to identify, formulate, and develop solutions for problems normally encountered in their organizations.**

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5. Collect, analyze and interpret data efficiently and effectively to solve systems analysis and engineering problems.

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6.

7. Evaluate the impact of their proposed solutions to engineering problems in the broader context of the organization or society.

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8.

9. Effectively communicate using written, oral and electronic media to articulate technical problems and their proposed solutions.

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10.

11. Recognize the need for life-long learning and growth within their chosen profession and to be familiar with the strategies they may employ to accomplish this.

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Please list below any additional objectives you believe should be targeted by our undergraduate ISE program.

Important Factors Not Included in the Educational Objectives

1. What are the top factors related to a recent college graduate’s institution that most strongly influence your opinions regarding her or his abilities and likelihood for success in your professional arena? Please select up to three.
   - Performance of other alumni from their institution at your worksite.
   - Performance of interns and co-op students from their institution at your worksite.
   - Popular national ranking of their institution (e.g. U.S. News "Best Colleges").
   - Professional recognition & achievement of faculty (publications, presentations, etc.).
   - Knowledge or perception of highly selective practices and tough academic standards.
   - Knowledge of particular or special or unique programs and curriculum at the institution.
   - Other (please specify):

2. Aside from academic institution, what are the top individual aspects of a recent college graduate that make him or her most desirable as an employee at your company? Please select up to three.
   - High academic performance (i.e. GPA, course load)
   - Prior professional work experience
   - Special or unique learning experience (interdisciplinary fields, minor degree, global studies, etc.)
- Observed ability to communicate effectively (e.g. interview, letters, portfolio, etc.)
- Self-presentation in terms of professionalism, confidence, etc.
- Specific practical skills (software tools, laboratory techniques, foreign languages, etc.)
- Recommendations from course instructors, former supervisors, etc.
- Other (please specify):

If you are familiar with the performance of any SJSU ISE graduates currently working in your organization, please provide any comments you believe would be useful.
Memo Summarizing Meeting with UPS to Discuss ISE Objectives
March 31, 2005

Memorandum for the Record

From: David Engelbert

Subject: Meeting with UPS to Discuss ISE Objectives

On March 17, 2002, Yasser Dessouky, Minnie Patel and I met with UPS personnel at their San Jose distribution center. Our primary interface was with Ingrid Sidiadinoto, a supervisor with UPS, who is an industrial engineer. Mike Pearson, another UPS supervisor and Heather, a relatively new management trainee, also represented UPS. In addition, two recent SJSU ISE graduates, Roberto Torres and Emma Lara, who are new UPS hires, attended the meeting. Our meeting time was early afternoon to accommodate all schedules and this was the inactive time for the distribution center. We were not able to observe the center during peak activity periods.

We had three primary purposes in meeting with the UPS personnel.

- Get feedback on the objectives and other parts of the on-line ISE survey for industry that has been sent to all Department Advisory Committee (DAC) members.
- Invite informal feedback from UPS on how they recruit and select industrial engineers.
- Invite informal feedback on what they value in the organization for new employees.

UPS personnel were very satisfied with the ISE department objectives and the other questions in the on-line survey. Subsequent to the visit, both Mike Pearson and Ingrid Sidiadinoto, completed the on-line survey.

Some background on UPS is important to understand their need and use for industrial engineers. The San Jose distribution center is part of the UPS northern California region. The region has about 5,000 employees and roughly 40 industrial engineers. They recruit in the local schools located in each UPS region. For northern California, they typically seek graduates from UC Berkeley, UC Davis, CalPoly and SJSU. They do not have preferred schools for recruiting. They sometimes hire math and economics majors even though their preference is for industrial engineers.

All new professional employees start as management trainees in a program that lasts about two years. At the end of this program all the program graduates become supervisors or managers in some capacity. In UPS there is extensive interaction with hourly employees who comprise the majority of the workforce. The UPS technical emphasis for industrial engineers includes work processes, flow control, operations research and forecasting.
UPS views the senior project experience as a primary strength of recent graduates. They view communication skills – especially writing, lack of database classes and lack of Excel skills as weaknesses in recent graduates. They identified individual strengths they seek as communication skills, technical competence and project experience.

UPS currently has a total of three SJSU ISE graduates and all are doing well. The UPS personnel were very helpful to us as we seek to identify ways to strengthen the Industrial and Systems Engineering program at San Jose State University.

Distribution:
Yasser Dessouky
Minnie Patel
Lila Dormishian
Lou Freund
Undergraduate Alumni Survey Form
1. Your Name:___________________________________________ Year(s) Graduated: __________

Your Email address: ____________________________ Phone Number:(______)______________

2. ISE Dept Degree(s) awarded:    ☐ BSISE    ☐ MSISE

3. Are you currently working as an IE or in a related field?    ☐ YES    ☐ NO

4. Current Job title:________________________________________________________________

5. Employer:_____________________________________________________________________

6. When did you start working for this employer?______________________________

7. Which industry are you currently working in?
   ☐ Manufacturing
   ☐ Service
   ☐ Government
   ☐ Software
   ☐ Other__________________________________________________________

8. Please list up to three previous job titles and employers starting with the most recent ISE position you held following graduation.

   a. (most recent position)__________________________________________________________________
      Dates:____________________________________

   b. (previous position)____________________________________________________________________
c. (previous position)

____________________________________________________________________

Dates: _____________________________

______________________________

   d. (first position)

____________________________________________________________________

Dates: _____________________________

9. List your most significant professional achievements since you graduated:

10. In the last 3-5 years, to what extent did you use the following ISE program topics.

   Simulation □ Not at all □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

   Work measurement □ Not at all □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

   SPC □ Not at all □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

   Optimization □ Not at all □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

   Production/Capacity Planning □ Not at all □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

   Supply Chain □ Not at all □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

   Process improvement/
     Cost reduction □ Not at all □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

   Other __________________________ □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

   Other __________________________ □ 1X/2X a year □ 1X/2X a quarter □ 1X/2X a mo

11. What topics/skills have you needed that we didn’t teach you?

12. What topics/skills did we teach you that you do not need?
13. What did we teach you that you wish you had understood better at the time?

14. What’s an example of a systems design challenge or other problem that you have solved for your organization? Was your solution accepted? Implemented?

15. Did the ISE program prepare you very well for your first and subsequent jobs? Why or Why not?

16. Have you taken any post graduate courses, training, workshops?

   a. What topics?
   b. Company sponsored?

17. Thanks for any thoughts or comments that will help us improve the ISE programs:
Improving the **Industrial and Systems Engineering** Undergraduate Education at San Jose State University to Prepare students for a successful career in industry.

**Employer Survey**

**ABOUT YOURSELF AND YOUR ORGANIZATION**

Job Function  

Company  

Industry  

**DESIRED SKILLS**

Please rank the importance of following skills according to your organizational needs:  
(1 = not important; 6 = most important; state and prioritize others using the space on the right.)

- Problem Solving/Analytical Skills  
- Leadership  
- Technical **Industrial Engineering** Skills  
  - Process Development  
  - Time Studies and Work Measurement  
  - Quality Control and Assurance  
  - Production Planning  
  - Simulation  
  - Project Management  
  - Operations Research  
  - Facilities Planning  
  - Supply Chain and Logistics  
  - Engineering Economic Analysis  
- Teamwork  
- Communications/Presentation  
- Related Job Experience

**CURRENT STATUS OF PERFORMANCE**

Do you have or know any employees in your organization who graduated from the undergraduate program in **Industrial and Systems Engineering** at SJSU?   Yes  No  

If Yes, how many such employees work in your organization?  

Based on you personal assessment, how would you rank these employees on average?  

___1st Quartile  ___2nd Quartile  ___3rd Quartile  ___4th Quartile
STRENGTHS AND AREAS FOR IMPROVEMENT

Based on your experience, please comment on the:

Strengths of SJSU-BS- Industrial and Systems Engineering graduates, including the skills listed above and specific technical competencies:

____________________ ____________________ ________________  
____________________ ____________________ ________________

Areas for Improvement for SJSU-BS- Industrial and Systems Engineering graduates, including the skills listed above and specific technical competencies:

____________________ ____________________ ________________  
____________________ ____________________ ________________

Please score each of the following ISE Undergraduate Program Objectives achievement on a scale of 1 to 5: 1 – Not at all, 2 – Somewhat, 3 – Met at Par, 4 – Above Expectation 5 – Way above Expectation in reference to ISE graduates’ performance in your company

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Score</th>
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<tbody>
<tr>
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<td>government, or service organization designing or improving</td>
<td>1 2 3</td>
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<td>and implementing efficient business processes.</td>
<td>4 5</td>
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<td>2. Use methodologies and computational skills to identify,</td>
<td></td>
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<td>formulate, and develop solutions for problems normally</td>
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<td>encountered in their organizations.</td>
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1. General Information
2. Rules and Policies
3. Requirements for B. S. degree
4. Flow Diagram of Required Courses
5. Sample Four-year Plan
6. Course Descriptions
7. General Education Check List
8. Major Form
9. Major Advising Form
10. Transfer Evaluation Form
11. Approved List of Technical Electives
General Information

Office Location
Engineering Building, corner of San Fernando & 7th Streets,
San Jose, 4th floor - Room 485

Office Hours
8:00 a.m. to 12.00 p.m. and 1:00 p.m. to 5:00 p.m.

Telephone
(408) 924 - 3301

Fax
(408) 924 - 4040

Email Address
isengr@email.sjsu.edu
ise@email.sjsu.edu

Web Site Address
http://www.engr.sjsu.edu/ise/

Chair
Dr. Lou Freund

Program Director and Major Advisor
Dr. Yasser Dessouky

Area Advisors
Dr. Yasser Dessouky
Production Systems and Simulation

Dr. Louis Freund
Ergonomics and Human Factor Engineering

Dr. Kevin Corker
Human Computer Interface

Dr. Jacob Tsao,
Operations Research and Applied Statistics
Mission Statement

To serve society, with emphasis on the manufacturing and service sectors by

- Providing undergraduate and graduate industrial and systems engineering education that prepares students to effectively apply engineering knowledge to the evaluation, design, and operation of complex industrial, service, and governmental systems comprised of people, equipment, and supplies through the application of modeling, measurement, and economic methods.

- Contributing to the enrichment of the profession and to the development of knowledge through faculty leadership, scholarship and professional practice.

- Meeting the needs of working professionals for continuing education in the fields of operations research, advanced statistical methods, ergonomics and human factors, production planning and control and related topics.

Educational Objectives

1. Function effectively as an ISE professional in any industry, government, or service organization designing, improving, and implementing efficient business processes.
2. Use methodologies and computational skills to identify, formulate, and develop solutions for problems normally encountered in their organizations.
3. Collect, analyze, and interpret data efficiently and effectively to solve systems analysis and engineering problems.
4. Evaluate the impact of their proposed solutions to engineering problems in the broader context of the organization or society.
5. Effectively communicate using written, oral and electronic media to articulate technical problems and their proposed solutions.
6. Recognize the need for life-long learning and growth within their chosen profession and to be familiar with the strategies they may employ to accomplish this.
Program Description

The BS - Industrial and Systems Engineering program prepares engineers for a broad scope of systems analysis and design challenges that deal with improving the overall performance of an organization or system. ISE’s focus is on productivity improvement, with concern for the human aspects of work as well as with finding the right combination of resources to ensure that the organization performs at its best. Using the latest computer-based analytical and modeling technologies, ISE bridges the gap between management and operations, applying organizational development, continuous improvement, Total Quality Management, ergonomics and production systems expertise. The goal of ISE is to assure that the organization’s systems are efficient, productive, safe and will not lead to cumulative injury, and that they incorporate the right tools and equipment. An industrial and systems engineer may be employed in almost any type of industry, business or institution, from retail establishments to manufacturing plants to government agencies to hospitals. The program prepares students to enter the profession immediately or to go on to graduate school. The undergraduate curriculum is accredited by the Accreditation Board of Engineering Technology (A.B.E.T.)
Rules and Policies

Major Advisor
A Major Advisor is a representative of the program who can assist you in selecting courses and develop a plan for fulfilling the SJSU and major requirements. You must consult your Major Advisor at least once each semester.

Writing Skill Test (WST) and Engr 100W
You must pass the WST and have upper division standing, in order to register for any Advanced General Education course (including Engr 100W). Engr 100W is a prerequisite for all Industrial and Systems Engineering senior courses. You are urged to take the WST as early as possible.

Placement Examinations
All undergraduate students must take the Entry Level Mathematics (ELM) Exam or be exempted from it before placement in the appropriate university mathematics coursework. All students who wish to enroll in the following courses are required to take the corresponding placement examinations.

* Engl 1A requires English Placement Test,
* Math 30 or Math 20 requires Calculus Placement Examination,
* Phys 70 requires Physics Placement Test,

Note, Phys 50 does not require a Physics Placement Test.

Drop Procedure
A student may petition to drop a course after the third week of instruction only for serious and compelling reasons. Poor performance in a class is not considered a serious and compelling reason for late-drop. Verification and meeting with the University office responsible for late drop are necessary.

Prerequisites and Corequisites
You can take an ISE course only if 1.) you have completed all prerequisites of the course before taking it, and 2.) you are taking all corequisites at the same time or have taken all corequisites before taking the course. A student taking a course without satisfying either of the above conditions will either be dropped by the instructor or get a failure grade.

Course Load
You should adjust your course load based on your scholastic records, working hours, and other factors. You should discuss your individual situation with your Major Advisor. Students will not be allowed to register for more than 18 units per semester without prior approval from the Department Chair with the Petition for Excess Units form.

Technical Electives
9 semester units of upper-division technical electives are required. You can select the technical electives from the approved list, however two technical electives must be selected from upper-level engineering courses. The choice of technical electives must be made in order to complete the Major Form. You need your Major Advisor’s approval (on the Major Form) to take any elective course that is not on the approved list. A “C” or better is required.

General Education
Questions on GE requirements should be directed to the Major Advisor who will refer the student to the student Resource Center, located in the Student Services Center underneath the 10th street garage, if further clarification is needed.
Major Form

An approved Major Form on file is required before taking any senior level ISE courses. A sample of the Major Form is included in this package. A major form must be submitted one (1) year prior to your anticipated date of graduation. In addition, the department office will contact you if there are any questions regarding your major form prior to approval. The following is the process to complete your Major Form. A major form can be downloaded as a word document from the department website: www. engr. sjsu. edu/ ise/.

1. You must see your advisor and submit your Major Form and the complete documents for the approval and signature.

2. The department will then check your grades and submit your Major Form and the documents to the department’s Chair for the signature.

3. Upon department verification and approval, your Major Form and the documents will be taken to the Dean’s office for further verification. If the packet is complete, it will be forwarded to Admissions and Records.

Documents to Attach to Major Form:

1. Major form checklist/cover page
2. Graduation application
3. General education checklist (official or copy signed by GE assessment advisor or stamped by Advising Center)
4. College of engineering General Education checklist
   a. Form A (Blue)-for students starting as freshmen
   b. Form B (Pink)-for transfer students
5. Graduation courses not completed for the baccalaureate degree
6. SJSU transcripts (will be printed by ISE department staff)
7. Other college/university transcript(s) (copies are acceptable)
8. Articulation agreement(s) printed from www. assist. org or equivalency form(s) for all course works that appear on your major form but were not completed at SJSU.

Reminder:

1. Any changes to a student’s approved major form must be documented by a (Changes of Course(s) on Major ) form.
2. Don’t forget to submit copies of the transcript(s) to the department for course(s) with a “Blank grade” that will be taken at another college/university (Be sure that an OFFICIAL copy goes to the office of Admissions and Records )
Transfer Evaluation

Before enrolling in ISE 102, ME 110, or ISE 130, you must see your Major Advisor to review credit for Mathematics, Physics, Chemistry, and Engineering coursework taken elsewhere.

Online course equivalents from other colleges can be reached on the Internet via WWW with the URL, http://artic.sjsu.edu/ or www.assist.org. These websites offer information on which courses can be transferred from the 131 colleges and universities holding articulation agreements with San Jose State University.

The following steps are required for a transfer credit evaluation:

1. Obtain a set of unofficial transcripts showing all the Mathematics, Physics, Chemistry, and Engineering courses taken elsewhere that you consider equivalent to the corresponding SJSU courses. Note that the Admissions Office does not make transcripts available to the ISE Department.

2. If applicable, obtain copies of catalog descriptions of pertinent courses that were taken at schools other than California community colleges. Clark Library normally has copies of catalogs for most U.S. colleges.

3. If applicable, attach catalog descriptions, and submit to the appropriate SJSU departments the Equivalency Evaluation forms for those courses taken at schools other than California community colleges. The U.S. college forms can be obtained from the ISE Office, while the foreign college forms are processed through the Admissions and Records Office. Following review, these forms should be returned to the ISE Department.

4. Complete the worksheet included in the Transfer Evaluation Packet in ink. A list of course equivalencies between California community colleges and SJSU is included. Courses not found in this list require the completion of Equivalency Evaluation forms by the pertinent department to complete the evaluation.

5. If all your pertinent transfer coursework was done at California community colleges, attach the set of transcripts to the completed worksheet and submit to your Major Advisor. Within a week or so, unless there are problems, your official transfer evaluation should be complete and placed in your file with the ISE Department.

6. If part (or all) of your pertinent transfer coursework was taken at schools other than California community colleges, attach the set of transcripts and copies of the signed Equivalency Evaluation forms to the completed worksheet and submit in person to your Major Advisor. Once processed, your official Transfer Evaluation will be signed by your Major Advisor and placed in your file with the ISE Department.
Requirements for B.S. Degree

(Total Minimum 130 Semester Units)

**General Education**

- Lower Division: 24 units
- Upper Division: 6 units
- Physical Education: 2 units
- Preparation for the Major: 29 units

**Mathematics**

- MATH 30, 31, 32, 129A, 133A: 16 units
- PHYS 70/71: 8 units
- CHEM 1A: 5 units

**Engineering Common Core**

- CMPE 46, ENGR 10, ME 20, EE 98, MATE 25
- ISE 102, 105, 115, 120, 130, 131, 135, 140, 151, 167, 170, 195A, 195B;
- ME 110, CmpE 131, ENGR 100W

**Approved Upper Division Electives**: 9 units

Total: 130 units
Sample Four-Year Program
(Total minimum units required for degree is 130)

### FRESHMAN YEAR: 33 units

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<th>Fall</th>
<th>Units</th>
<th>Spring</th>
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<tr>
<td>Math 30</td>
<td>3</td>
<td>Math 31</td>
<td>4</td>
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<tr>
<td>Chem 1A</td>
<td>5</td>
<td>Phys 70</td>
<td>4</td>
</tr>
<tr>
<td>Engr 10*</td>
<td>3</td>
<td>ME 20</td>
<td>2</td>
</tr>
<tr>
<td>Engl 1A</td>
<td>3</td>
<td>Engl 1B</td>
<td>3</td>
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<tr>
<td>Oral Communication</td>
<td>3</td>
<td>Human Understanding &amp; Development</td>
<td>3</td>
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<td><strong>Total</strong></td>
<td>17</td>
<td><strong>Total</strong></td>
<td>16</td>
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* Transfer upper-division students may substitute an engineering science course for Engr 10.

### SOPHOMORE YEAR: 33 units

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<th>Spring</th>
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<tr>
<td>Math 32</td>
<td>3</td>
<td>MatE 25</td>
<td>3</td>
</tr>
<tr>
<td>Phys 71</td>
<td>4</td>
<td>EE 98</td>
<td>3</td>
</tr>
<tr>
<td>American Studies 1A</td>
<td>6</td>
<td>Math 133A</td>
<td>3</td>
</tr>
<tr>
<td>Human Performance</td>
<td>1</td>
<td>American Studies 1</td>
<td>6</td>
</tr>
<tr>
<td>CmpE 46</td>
<td>3</td>
<td>Human Performance</td>
<td>3</td>
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<tr>
<td><strong>Total</strong></td>
<td>17</td>
<td><strong>Total</strong></td>
<td>16</td>
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Passing Writing Skills Test (WST) is required before taking Engr 100W

### JUNIOR YEAR: 33 units

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<th>Fall</th>
<th>Units</th>
<th>Spring</th>
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<tbody>
<tr>
<td>ISE 102</td>
<td>3</td>
<td>ISE 131</td>
<td>3</td>
</tr>
<tr>
<td>ME 110</td>
<td>3</td>
<td>ISE 120</td>
<td>3</td>
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<tr>
<td>ISE 130</td>
<td>3</td>
<td>ISE 170</td>
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<tr>
<td>Engr 100W</td>
<td>3</td>
<td>ISE 105</td>
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<tr>
<td>Math 129A</td>
<td>3</td>
<td>Advanced General Education</td>
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<tr>
<td>CmpE 131</td>
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All ISE senior courses require the completion of Engr 100W and Major Form on file

### SENIOR YEAR: 31 units

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ISE Course Descriptions

ISE 102. Engineering Economic Systems
Systems analysis applied to economic decisions in engineering; comparison of alternatives based on cost breakdown structure and time value of money; system life-cycle process; life-cycle economic concepts, costing methodology and applications. Corequisite: Math 31. 3 units

ISE 105. Introduction to Systems Engineering and Activity Costing
Techniques for integrating engineering problem solving methods with systems theory including principles of problem identification, description, modeling, solution and implementation; applying traditional and activity based cost systems to assist engineers in decision making process through the product life cycle. Pre/corequisites: ISE 130. 3 units

ME 110. Manufacturing Processes
Fundamentals of manufacturing processes such as machining, forming, cutting, welding and casting. Selection of materials. Production facility practices and meteorology. Geometric dimensions and tolerancing. Prerequisite: MatE 25, ME 20. Misc/Lab: Lecture 2 hours/lab 3 hours. 3 units

ISE 112. Occupational Health Engineering
Legislative framework and historical perspective of work-related injuries and diseases: prevention assessments, legal and regulatory issues surrounding solutions to occupational health problems, principles of industrial hygiene and program management. Prerequisite: Junior standing in engineering. 3 units

ISE 114. Safety Engineering
Hazards, accident prevention and engineering approaches to the design of equipment, facilities and processes. Provides familiarity with system safety, system evaluation and evaluation of alternative countermeasures. Latest safety regulations and agencies responsible for their enforcement. Prerequisite: Junior standing. 3 units

ISE 115. Computer Integrated Manufacturing
Analyze, design and integrate manufacturing processes with CAD/CAM technologies including numerical control, material handling and storage, group technology and computer control. Prerequisite: ME 110. Misc/Lab: Lecture 2 hours/lab 3 hours. 3 units

ISE 120. Work Methods Design and Measurement
Design of efficient and effective work processes; includes process management, methods analysis and improvement and work measurement. Corequisite: ISE 130. Lecture 2 hours/lab 3 hours. Lab fee required. 3 units.

ISE 130. Engineering Probability & Statistics
Probability theory, graphical displays of data, graphical methods of comparisons of samples and hypotheses testing, Statistical estimation and inference. Uses graphical statistical packages. Prerequisite: Math 32. 3 units

ISE 131. Statistical Process Control and Improvement
Statistical computations, sampling procedures, development and use of control charts and utilization of computerized statistical packages. Design of statistical quality control systems. The seven tools of quality; process capability studies. Prerequisite: ISE 130 (with a grade "C-" or better) or equivalent. Misc/Lab: Lecture 2 hours/lab 3 hours. 3 units

ISE 135. Design of Experiments
Tests of composite hypotheses, analysis of variance, statistical decision theory, sampling procedures, design and implementation of statistical process control systems, response surface experimental design, Taguchi experimental design, system reliability, utilization of computerized statistical packages.
Prerequisite: ISE 130 (with grade of "C-" or better) or equivalent. 3 units

**ISE 140. Operations Planning and Control**
Design, implementation and evaluation of manufacturing, planning and control systems. Includes MRP II, ERP, JIT.
Prerequisite: ISE 102, ISE 120, ISE 170. 3 units

**ISE 151. Managing Engineering**
Broad overview of engineering management theory and practice including: management's roles, responsibilities, skills, strategy and planning; management systems, human resource management, problem solving and decision-making; engineering ethics. Prerequisite: 100W course. 3 units

**ISE 155. Supply Chain Engineering**
A comprehensive coverage of supply chain topics; real world applications including logistics, inventory management, risk pooling, value of information, strategic alliance, procurement and outsourcing strategies, information technology, coordinated product and supply chain design, customer value, decision support systems. Prerequisite: ISE 140. 3 units

**ISE 162. Engineering Statistics and Analysis**
Topics will include error analysis, probability, statistics including hypothesis testing, confidence limits and control variables, design of experiments and statistical process control as they are utilized in the chemical, materials and process engineering industries. Prerequisite: Math 133A. Corequisite: ChE 115 or MatE 115. 3 units

**ISE 164. Computer and Human Interaction**
Introduction to human/computer interaction, paradigms for interaction, human performance capabilities, computer input/output device analysis and design, pattern recognition 3D audio, 3D visualization, application to virtual reality and multimedia. Prerequisite: Engr 100W, ISE 130. 3 units

**ISE 167. System Simulation**
Introduction to simulation. Monte Carlo techniques. Design and use of discrete-event computer simulation modeling techniques; theoretical and practical treatment of input to models; model validation methods and output analysis. Synchronized sampling, model comparisons. Prerequisites: CmpE 46, ISE 130 (with grade “C-” or better), ISE 170. Lab fee required. 3 units

**ISE 170. Operations Research**
Development and application of mathematical models to industrial problems. Linear programming, network analysis, Markov models, game theory, queuing theory and decision analysis. Prerequisite: ISE 130 (with grade of "C-" or better). Pre/corequisites: Math 129A. 3 units

**ISE 180. Individual Studies**
Individual work on special topics by arrangement. Prerequisite: Upper division standing and instructor consent. Repeatable: Repeatable for credit. CR/NC 1-3 units

**ISE 195A. Senior Industrial Engineering Design I.**
Individual or group design projects. Proposal preparation with plans and specifications. Oral and written reports. Professional seminars. Prerequisite: ISE 105, ISE 120, ISE 170, Engr 100W, major form on file and senior standing. Misc/Lab: Lab 3 hours. 1 unit

**ISE 195B. Senior Industrial Engineering Design II.**
Design of a complete industrial system including quality function deployment, technology trends, financial analysis, functional specifications, process design, production capability, quality management, manufacturing resource planning, equipment requirements, human resource management, management information systems, facility design and project management. Prerequisite: ISE 140 and ISE 195A (with grade of "C" or better). Misc/Lab: Lab 9 hours. 3 units
ISE 197. Cooperative Education Project
Part or full-time on-site paid work experience based on a pre-approved project assignment in area of student's career objective. Oral presentations, written final report and evaluation by project supervisor. Approved technical elective. Prerequisite: Instructor consent. 3 units

ISE 199. Special Topics in Industrial & Systems Engineering
Contents vary from semester to semester
General Education Checklist for Students Entering as Freshmen Only
Form A

Name__________________________SS#__________________Major_____________________

General Education Core (Select Plan 1 or Plan 2)

Plan 1: American Studies Program (24 units)
Skills courses: grades of “C” or better required in A1, A2 & C3 courses
English 1A (A2)  3 units ______  English 1B (C3) 3 units ______
Oral Communication (A1) 3 units ______ Human Understanding and Development (E) 3 units ______
American Studies 1A 6 units ______ American Studies 1B 6 units ______

Plan 2: Humanities Honors Program (by invitation only) (24 units)
Grades of “C” or better in all four courses
Humanities 1A 6 units ______ Humanities 1B 6 units ______
Humanities 2A 6 units ______ Humanities 2B 6 units ______

Notes:
1. Engineering students satisfy the Mathematics (with grades of “C” or better in Math 30, 31 or 32) and Science requirements of General Education through courses taken for the major. Both Plan 1 and Plan 2 satisfy the remainder of Core General Education.
2. Both Plan 1 and Plan 2 satisfy the American Institutions requirement.
3. Students not taking Plan 1 or Plan 2 should use Form B.

Students Must Pass the WST (Writing Skills Test) Before Taking
Advanced General Education

Advanced General Education (9 units)

1. Areas R & Z: Earth & Environment & Written Communication II
   Engineering 100W 3 units ______

2. Area S: Self, Society and Equality in the United States 3 units ______

3. Area V: Culture, Civilization, and Global Understanding 3 units ______

Fill in the course number and the semester taken, as appropriate. Transfer Students Use Form B
College of Engineering
General Education Checklist for Transfer Students
Form B

Name_______________ SS#________________ Major______________

General Education Core (27 units)

Skills courses: grades of “C” or better required in A1, A2 and C3 courses

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Notes:
1. Students who complete the IGETC or CSU BREADTH programs at Community College receive full credit for Core GE. Students who do not complete either of these programs must satisfy the 27-unit requirement given above. Individual courses within this requirement can be satisfied by courses taken at Community College.
2. Engineering students satisfy the Mathematics (with grades of “C” or better in Math 30, 31 or 32) and Science requirements of General Education through courses taken for the major. The courses listed above satisfy the remainder of Core General Education.
3. For Social Science D2-D3, students should take one of the following sequences:
   a. History / Political Science 15A-15B
   b. Afro-American Studies 2A-2B
   c. Asian American Studies 33A-33B
In order to satisfy the American Institutions requirement.
4. Students who take Social Science (D2, D3) at Community College should make sure that those courses also satisfy the American Institutions requirement.

Students Must Pass the WST (Writing Skills Test) Before Taking Advanced General Education

Advanced General Education (9 units)

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<td>Area V: Culture, Civilization, and Global Understanding</td>
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Fill in the course number and the semester taken, as appropriate.

Students Entering as Freshmen Use Form A
San Jose State University
College of Engineering  
Department Industrial & Systems Engineering  
Major Form for B. S. in Industrial & Systems Engineering

Name ___________________________________________________________     SSN _______________________________  
Last                               MI                      First

Minimum number of semester units for the degree: 130     Bulletin: ____________   Proposed Date of Graduation ____________

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REQUIRED COURSES (minimum 46 units)

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APPROVED TECHNICAL ELECTIVES (minimum 9 units)

Courses Required in Preparation for the Major – Mathematics, Chemistry, Physics (minimum 29 units)

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(Student's Signature)______________________________________________________________will have completed all the
Requirements for the Bachelor of Science in ISE after: (a) successful completion of the above work. (b) An audit of the student’s transcript of
record to verify that all-appropriate data has been entered accurately. (c) A minimum 2.0 GPA in all required courses has been achieved. (d) A
minimum 2.0 GPA in all required and technical electives combined has been achieved. (e) A minimum 2.0 GPA in all required courses and
technical electives taken at SJSU has been achieved.

[Signed] ___________________________________________          [Signed] _____________________________________
Major Advisor.                                             Department Chair
[Date] ___________________________________________________ [Date] ____________________________________
# Major Advising Form for B. S. in Industrial & Systems Engineering

<table>
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<th>Bulletin</th>
<th>Advisor</th>
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| Engr 100W | 3 |
| Math 129A | 3 |
| CmpE 131 | 3 |

| Tech Elec. | 3 |
| ISE 135 | 3 |
| ISE 140 | 3 |
| ISE 167 | 3 |
| ISE 195A | 1 |
| ISE 151 | 3 |

| Major Form | |
| ISE 195B | |
| ISE 115 | |
| Tech Elec. | |
| Tech Elec. | |
| Adv. GE | |

Advisor Initials: _ _ _ _ _ _ _ _ _ _
Advising Date: _ _ _ _ _ _ _ _ _ _
Flag-off Initials: _ _ _ _ _ _ _ _ _ _
Flag-off Date: _ _ _ _ _ _ _ _ _ _

C-32
Transfer Evaluation Form for B.S. In Industrial & Systems Engineering

Name ________________________________   ________________________________  __________
M.I. ____________

Date of Entry to SJSU ___________________________________________________________________

SSN _______________________________________________________________________________

Previous College Work

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Major Advisor Signature __________________________ Date _______________________

* Show S(semester) or Q(quarter) next to the number of units for each entry in this column.
APPROVED LIST OF TECHNICAL ELECTIVES
(Note at least two electives must be engineering course and all courses must be completed with a grade of “C” or better)

Software Systems Engineering

CmpE 120 Computer Organization and Architecture
CmpE 135 Object-Oriented Analysis and Design
CmpE 133 Software Engineering II
Engr 136 Information Engineering
CmpE 124. Digital Design I
CmpE 126 Algorithms and Data Structure Design
CmpE 130. File Processing
CmpE 138. Database Systems Design
CmpE 148. Computer Networks

SemiConductor/ Manufacturing

MatE 153  Electronic Properties of Solids
MatE 141  Materials Characterization
MatE/EE 129 Basic IC Processing
MatE 130  Characterization and Analysis of Semiconductor Devices
MatE/EE 167 Microelectronics Manufacturing Methods
MatE/ChE 166  Advanced Thin Films Processes
ME 106 Fundamentals of Mechatronics Engineering
ME 109 Heat Transfer in Electronics
ME 136 Design For Manufacturability
ME 165 CAD in Mechanical Engineering

Human Factors/Ergonomics

ISE 112  Engineering Occupation and Health
ISE 114. Safety Engineering
CE  170 Principles of Environmental Engineering
ISE 164 Computer and Human Interaction
Psyc 170 Industrial Organization Psychology
Psyc 173 Human Factors

Transportation and Traffic Management

CE 121  Transportation Engineering
CE 122  Traffic Engineering
CE 134  Project Management for Construction

Business Management

ISE 155. Supply Chain Engineering
Psyc 175 Management Psychology
Bus 130 Introduction to Marketing
Bus 133A International Marketing
Bus 133B International Marketing: Pacific Rim
Bus 168 Management Issues in High Technology Firms
Bus 170 Business Finance

ISE Related

ISE 196J ISE Applications in Service Sector
ISE 196R Reliability Engineering
ISE 197 Cooperative Education Project
Senior Design Project Checklist
CHECK LIST TO EVALUATE PROJECT REPORT  
(D: description, T: table, F: figure)

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 [p24, Fig 2.2]  
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) [Isometric p39, Fig 2.10]
   F- Drawings (CAD drawings) of other key components
   F- Drawings (CAD drawings) assembly drawing of product [p39, Fig 2.9]

2.2 Bill of Materials
   D - Summary
   F - Multilevel tree structure [p392, Fig 11.3] (including options and features)
   T - Indented BOM

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-t-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 [p137, Fig 5.1]
F- Assembly charts for scheduling production [p137, Fig 5.2]
F- Operation process chart [p138, Fig 5.3] [p33, Fig 2.8]
F- Production routing sheet [p140, Fig 5.5]

4.3 Production Capacity
D-Assumptions, input variables, summary
D-Line balancing, definitions of lead-time, cycle-time, yield, and throughput [p56]
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 [p39, Fig 2.13, 2.14]
F- Material Flow Process Chart for major operations [p144, Fig 5.9] [p37, Fig 2.11]
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)

Ref: Advanced Concepts in Production Planning p. 613, Mathematical Programming Approaches. Ref: Handout of Q1 costs for personnel
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 (conveyors, carts, trolleys, roller-rack/bin systems) [p100]
T- Machine to Machine Material Handling Table [p349, Fig 10.12]
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 [p437, Table 12.1]
T- Office space requirements [p438, Table 12.2]
T- Facility space requirements [p437, Table 12.1]
T- Relationship chart priority codes [p438, Table 12.3] [p114, Table 3.3]
T- Activity Relationship chart [p438, Table 12.4] [p113, Table 3.20]
T- Value chart [p444, Table 12.14]
F- Nodal diagram [p445, Table 12.4, 12.5]
T- Block calculations [p445, Table 12.15]
F- Block diagram of layout (CAD diagram) [p449, Table 12.12]
F- Plant layout: production area layout (CAD diagram)
F- Plant layout: plant site layout (CAD diagram) [p466, Table 12.20]

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
T- Depreciation of material handling equipment

6.3 Inbound Storage and Warehousing
D-Storage policy, functions, location, size, staffing, operations, and performance
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, IROR, ROA) vs. time (Engr. Econ Analysis)
F. Break-even-point analysis: revenue and cost vs. volume

7.3 Computer Information System (handout)
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
T- Manpower data over time: position vs. quantity, costs
D-Organization charts over time [p4, Fig 1.1]

7.6 Implementation Schedule
D-Decision procedure, assumptions, justifications
F- Start-up implementation schedule - Gantt, CPM/PERT charts [p26-27, Fig 2.4]

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

APPENDICES
T- Detailed tables
F- Detailed figures

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<th>C_H</th>
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<td>The cost of firing an employee</td>
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<td>The cost per labor hour of overtime production</td>
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<td>The cost per month of carrying one labor hour of work</td>
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<td>The hours stored in inventory at time 0 – the initial inventory level</td>
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<td>A_5</td>
<td>The desired number of employees at the end of each planning horizon</td>
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BS ISE Senior Exit Survey
ISE Graduating Senior Exit Survey

For students graduating in May 2003

The DAC (Department Advisory Council) for the Industrial and Systems Engineering Department is dedicated to the continuous improvement of our undergraduate programs. The information that you provide by means of this survey will be very helpful in this improvement process. We appreciate your feedback.

YOUR UNDERGRADUATE EXPERIENCE

An Overview:

We are interested in assessing your overall development as a professional while you were an ISE student at SJSU. This includes your opinions about our curriculum, your assessment of your own skills and professional preparation and your perception of the support you received from faculty and staff in helping you to achieve your goals. You will also have an opportunity to comment on particularly influential courses, faculty, and staff members, among other things.

I. Self Evaluation of Knowledge and Abilities

Please give us your feedback on the following knowledge and abilities generally expected of an engineering professional. Base your responses on your total learning experience as a student (courses, interactions with faculty and other students, personal confidence level, etc.). Please feel free to use the space after the listings to briefly explain any of your responses, especially if your preparation was less than adequate. Use a scale of one (1) to five (5) where:

1 = None  2 = Below Ave  3 = Average  4 = Very Good  5 = Excellent  NA = Not Applicable

Rate Your Knowledge in:  1 2 3 4 5 NA

1  Basic Sciences (Physics, Chemistry, etc.)

2  Mathematics (Calculus, Linear Algebra, Differential Equations)

3  Probability and Statistics
4 The Engineering Sciences in General
5 Engineering Design Principles
6 Engineering Professionalism and Ethical Standards

7 Team Work
8 The Socio-Economic context in which Engineering is Practiced

9 Comments:

Rate Your Ability to:  1  2  3  4  5  NA

10 Integrate Knowledge and Information for Engineering Problem Solving
11 Communicate Ideas and Results Verbally
12 Communicate Ideas and Results in Writing
13 Communicate Engineering Ideas and Results Graphically (drawings)

14 Work Effectively in Teams
15 Build and Lead Team Processes or Outcomes (effectively lead)

16 Locate Needed Information and Knowledge
17 Self-Learn
18 Work Effectively in an International or Global Environment

19 Comments:

II. Evaluation of Engineering Courses
For each course taken at SJSU, rate its value (as you perceive), toward your academic development and/or potential job and career enhancement. For courses not taken, simply mark off in the “NA” space. If you do not see a course listed, please write it in below where the space is provided.

1 = None  2 = Below Ave  3 = Average  4 = Very Good  5 = Excellent  NA = Not Applicable

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C-45
33 ISE 155 Supply Chain Engineering
34 ISE 164 Computer and Human Interaction
35 ISE 167 System Simulation
36 ISE 170 Operations Research
37 ISE 180 Individual Studies
38 ISE 190 Industrial Engineering Design
39 ISE 195A Senior Industrial Engineering Design I
40 ISE 195B Senior Industrial Engineering Design II
46 ISE 156 Packaging Machinery and Systems

49 ISE _____

50. Please comment on courses that were particularly valuable, or otherwise memorable to you. (Explain)

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

III. Evaluation of Industry Based and Other Projects

Consider all the project work you have done through the course of your ISE major. Rate the value of those projects and distinguish between industry based (or based on real-life situations) and other projects.

51. How many total projects have you participated in as an ISE student? ____________

52. How many industry related only projects have you participated in as an ISE student? __________
Rate the Value of Projects: 1 2 3 4 5 NA

53  Senior Capstone Project  Industry_____

54  ISE _______ Course Project  Industry_____

55  ISE _______ Course Project  Industry_____

56  ISE _______ Course Project  Industry_____

57  ISE _______ Course Project  Industry_____

58. Comment on your industry related project experience. What were some of the rewards/difficulties you experienced, and how can those difficulties, if any, be improved for future students.

______________________________________________________________________________
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IV. Evaluation of ISE Laboratories and Equipment

Rate the Quality of Labs and Equipment: 1 2 3 4 5 NA

59  ISE 115 Lab
65. Comment on your lab experience. Describe some of the positive/negative experiences you have had. Did you receive adequate guidance and assistance while participating in the many lab exercises?

______________________________________________________________________________
______________________________________________________________________________
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V. Evaluation of ISE Faculty and Staff

Consider the full-time faculty (Freund, Tsao, Dessouky, Corker, Patel, Unwin) as a team, and rate them on the following criteria.

Rate the ISE Full-Time Faculty on: 1  2  3  4  5  NA

66 Courteousness, Friendliness, and Ease to Approach

67 Demonstrated Knowledge and Expertise in Subject Matter

68 Effectiveness of Classroom Instruction

69 Course and Classroom Management

70 Availability of Out-of-Class Assistance

71 Quality of Out-of-Class Assistance

72 Use of Technology- Interactive Website with Relevant Course Postings
Consider the adjunct (part-time) faculty as a team, and rate them on the following criteria.

Rate the ISE Adjunct Faculty on: 1 2 3 4 5 NA

75 Courteousness, Friendliness, and Ease to Approach

76 Demonstrated Knowledge and Expertise in Subject Matter

77 Effectiveness of Classroom Instruction

78 Course and Classroom Management

79 Availability of Out-of-Class Assistance

80 Quality of Out-of-Class Assistance

81 Use of Technology- Interactive Website with Relevant Course Postings

82 Use of Technology- Email in a Timely Fashion

83 Use of Technology- Computers and Software in the Classroom

Consider the office staff as a team, and rate them on the following criteria.

Rate the ISE Staff on: 1 2 3 4 5 NA

84 Courteousness, Friendliness, and Ease to Approach

85 Ability to direct students with ISE major and administrative concerns

86 Available on a Regular Basis
87 Use of Technology- Computers and Software
88 Use of Technology- Email in a Timely Fashion

Consider the ISE Department on the whole, and rate them on the quality of advisement.

Rate the Quality of ISE Dept. Advisement on: 1  2  3  4  5
NA

89 Academic Planning
90 Career Planning
91 Graduate Education

1 = None  2 = Below Ave  3 = Average  4 = Very Good  5 = Excellent  NA = Not Applicable

92. Please comment on your overall experience with faculty and staff. Was there any one person who stood-out to make you educational experience more than worthwhile?
93. Please comment on any coop/internship you participated in during your ISE education. Did you obtain one through the ISE faculty? Did you want one and not receive it? (Explain)

94. Please list the major strength(s) of your ISE education SJSU:

95. Please list areas for improvement in the ISE undergraduate program:
96. With respect to the previous question, do you have any specific suggestions on how to improve the curriculum, lab experience, or faculty interactions within the ISE program?

97. Do you plan on keeping an active connection with the ISE department after graduation? Why or why not?
98. Do you plan on pursuing a graduate Degree in the near future?

99. Would you recommend the ISE undergraduate Program at SJSU to a potential student or colleague?
100. Please convey any other comments you’d like the faculty, staff or administration to receive.

Again, thank you for the feedback
Undergraduate Course Syllabi with their Objects Mapped to ABET Outcomes
Industrial and Systems Engineering 102: Engineering Economic Analysis (Required)

Course Description: 3 CR. U. Systems analysis applied to economic decisions in engineering; comparisons of alternatives based on cost breakdown structure and time value of money; system life-cycle process; life cycle economic concepts, costing methodology and applications. Corequisite: Math 31


Class/Laboratory Schedule: Two 75-minute lecture per week

Course Objectives:
1. Introduce Students to the fundamental concepts of engineering economy
2. Develop understanding of engineering costs, cost estimation, cash flow diagrams, time value of money, and various interest formulas through examples.
3. Have students learn present worth, annual cash flow, rate of return, incremental and other engineering economic analysis methods using examples, and learn evaluation and selection of new alternatives in economic analyses.
4. Have students learn about income taxes as an important element of most economic analyses. For capital equipment, depreciation is required to compute income taxes. For this purpose, various methods to calculate depreciation and fundamentals of depreciation calculation are introduced with examples and how depreciation is used in income taxes calculations is illustrated.
5. Have students learn to deal with questions, such as should the existing equipment be retained or replaced. Help students develop skills to do the replacement analysis.
6. Have students learn how to use spreadsheets to do engineering economic analysis.
7. Have students understand the role of inflation and price change in engineering economic analysis.

Topics Covered:
- Introduction to Engineering Economic Analysis
- Nominal Interest
- Effective Interest
- The Decision Making Process and Engineering Decision Making
- Present Worth Analysis
- Annual Cash Flow Analysis
- Cash Flow Rule of Signs
- Incremental Analysis
- Other Analysis Techniques
- Depreciation
- Income Taxes

Contribution of Course to Meeting the Professional Component:
The students are required to use real life numbers for interest rates, mortgage plans, tax rates and depreciation plans, etc. in there course work. Courses instruction refers to daily practices during lectures to explain various economic concepts, such as financing plans, taxation laws, and various personal investment plans.

Prepared by: Dr. Minnie Patel
**ISE 102: Engineering Economic Analysis**

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

| Q#   | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1    | 3   | 2   | 2   |     |     |     |     |     |     |     |     |     |
| 2    | 3   | 3   | 2   |     |     |     |     |     |     |     |     |     |
| 3    | 3   | 3   | 4   |     |     |     |     |     |     |     |     |     |
| 4    | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 5    | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 6    | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 7    | 4   | 5   | 5   |     |     |     |     |     |     |     |     |     |
| 8    | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 9    | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 10   | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 11   | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 12   | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 13   | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 14   | 4   | 4   | 5   |     |     |     |     |     |     |     |     |     |
| 15   |     |     |     |     |     |     |     |     |     |     |     |     |

**Learning Objectives:**

- Ability to apply concepts of equivalence to engineering economic decision-making
- Ability to compute nominal interest
- Ability to compute effective interest
- Use and summarize engineering decision making and decision making process through application and analysis
- Ability to formulate and analyze problems with present worth method
- Ability to formulate and analyze problems with annual cash flow method
- Ability to formulate and analyze problems with rate of return method
- Ability to formulate and analyze problems with incremental analysis method
- Ability to describe and apply other analysis techniques
- Understanding depreciation and its impact on economic analysis
- Understanding income taxes and its impact on economic analysis

**Note:** Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)
Industrial and Systems Engineering 105: Introduction to Systems Engineering and Activity Costing (Required)

Course Description: 3 CR. U. Techniques for integrating engineering problem solving methods with systems theory including principles of problem identification, description, modeling, solution and implementation; applying traditional and activity based cost systems to assist the engineers in decision making process through the product life cycle. Corequisite: ISE 130.


Class/Laboratory Schedule: Two 75-minute lectures per week

Course Objectives:
Modeling tools and their use with respect to system optimization and architecture evaluation will be presented. System engineering management practice and systems engineering will conclude this course. The course will be divided into three components.

1. The first will address the process of system engineering as applied across system life cycle.
2. The second will provide introduction to, and application of sets of models& tools and methods, applied to problem formulation, problem analysis (including modeling techniques).
3. The third address interpretation of alternatives and decision processes as applied to system engineering management.

The student will receive information tools and techniques to support their:
• ability to design and conduct experiments, as well as to analyze and interpret
• ability to design a system, component, or process to meet desired needs
• ability to identify, formulate, and solve engineering problems
• understanding of professional and ethical responsibility
• ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Topics Covered:
• Introduction & System Life Cycles
• System Definition, System Design Lifecycle
• Functional Analysis & Conceptual Design
• Prototype Development
• System Test & Development
• Models of Decision Making
• Models of Econometric Evaluation, Optimization, Queuing Models
• Optimization
• Human Factors
• Supportability & Maintainability

Contribution of Course to Meeting the Professional Component:
The system design methods and analyses are taken from current production practice and social policy. The student’s take a system from conceptual design through critical design review in weekly progress projects. The data, process constraints and engineering practice required to support that project process are all based in current engineering practice.

Prepared by: Kevin Corker, Professor
### ISE 105: Introduction to Systems Engineering and Activity Costing

#### Contribution of Course to Program Outcomes

**Level of Learning by Topic/Activity**

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**Learning Objectives:**

- Ability to apply System Definition and System Lifecycles
- Understanding and Application of the systems engineering Process
- Understanding and the application of the Conceptual Design Process
- Ability to perform a functional analysis
- Ability to apply System Test Development
- Ability to perform system modeling
- Understanding of Econometric Models
- Application of Optimization
- Understanding of Human Factors
- Understanding of Reliability and Sustainability

Note: Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)
Industrial and Systems Engineering 112: Occupational Health Engineering (Technical Elective)

Course Description: 3 CR. U. Legislative framework and historical perspective of work-related injuries and diseases: prevention assessments, legal and regulatory issues surrounding solutions to occupational health problems, principles of industrial hygiene and program management. Prerequisite: Junior standing.


Class/Laboratory Schedule: One 3-hour lecture per week.

Course Objectives:
1. To know which government agencies are responsible for worker health and the role employers must play in order to meet regulations.
2. To know industrial hygiene and be able to apply its principles in the workplace.
3. To understand the environmental impact of chemical hazards and know the proper disposal methods.
4. To be able to assess and analyze risks of chemical, biological, and physical origin.
5. To be able to design engineering solutions to specific process problems.

Topics Covered:
- Importance of Safety and Health for Engineers
- Safety and Health Professions
- Fundamental Concepts and Terms of Injury and Illness Prevention
- Federal Agencies, Laws and Regulations
- Workers Compensation
- Record Keeping and Reporting
- General Principles of Hazard Control and the Hierarchy of Controls
- Heat and Cold Hazards
- Pressure Hazards
- Visual Environment Hazards
- Ionizing Radiation Hazards, Non-ionizing Radiation Hazards
- Chemicals and Toxicology
- Chemical and Industrial Hygiene Measurements
- New United Motor Plant Tour
- Ventilation
- Biohazards and Building Protection From Threats
- Noise and Vibration
- Hazardous Wastes and Environment Protection

Contribution of Course to Meeting the Professional Component:
The fundamentals of hazard identification, the evaluation of risk, and the control of hazards is given. The student learns the roles and responsibilities of the engineer to eliminate and control hazards and to effectively communicate and educate management and affected employees working in an industrial environment.

Knowledge of the fundamentals of chemistry, physics and mathematics are applied to identify and quantify potentially hazardous exposures to airborne contaminants, noise, radiation and biological agents. Engineering design is necessary to develop control methods, such as shielding, guarding and mechanical exhaust ventilation.

### ISE 112: Occupational Health Engineering

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

<table>
<thead>
<tr>
<th>Learning Objectives:</th>
<th>Understanding the Importance of Safety and Health for Engineers</th>
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<th>HW, Test #1</th>
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<td>Understanding and Knowledge of General Principles of Hazard Control and Hierarchy of Controls</td>
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<td>HW, Test #2</td>
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<td>Understanding and Calculation of Heat and Cold Hazards</td>
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<td>HW, Test #2</td>
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<tr>
<td>Identify and Calculate Pressure Hazards</td>
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<td>HW, Test #2</td>
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<tr>
<td>Identify and Analyze Visual Environment Hazards</td>
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<td>4</td>
<td>HW, Test #2</td>
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<tr>
<td>Analyze and Evaluate Non-ionizing Radiation Hazards</td>
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<tr>
<td>Analyze and Evaluate Ionizing Radiation Hazards</td>
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<td>HW, Test #2</td>
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<td>Application of Chemicals and Industrial Hygiene Measurements</td>
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<tr>
<td>Calculate Proper Ventilation Requirements</td>
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<td>Understanding of Biohazards and Building Protection from Threats</td>
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<tr>
<td>Analyze and Calculate Noise and Vibration Hazards</td>
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Note: Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)
Industrial and Systems Engineering 114: Safety Engineering (Technical Elective)

Course Description: 3 CR. U. Hazards, accident prevention and engineering approaches to the design of equipment, facilities and processes. Provides familiarity with system safety, system evaluation and evaluation of alternative countermeasures. Latest safety regulations and agencies responsible for their enforcement. Prerequisite: Junior standing.

Textbook: Safety and Health for Engineers. Roger L. Brauer, John Wiley & Sons; Reprint edition (September 1994) 047128632X.

Class/Laboratory Schedule: One 3-hour lecture per week.

Course Objectives:
The student will develop and understanding of the role and responsibility of a Safety Engineer by learning how safety standards are set and implemented in a company. Principles of safety management in a company will be examined. Government standards, laws and regulations will be examined and applied to case studies. Quantitative methods used in safety data analysis, plus the safety regulations and agencies responsible for their enforcement, will also be covered. Methods of risk and hazard analysis will be covered, especially as applied to fires and explosions. Combustion theory and Hazard avoidance will be examined. Students should be able to evaluate fire and explosion hazards and risks in the chemical process industries.

Topics Covered:
- Occupational Safety Concepts and Laws and Regulations
- Worker’s Compensation Insurance
- Product Liability
- General Principles of Hazard Control
- Mechanics and Structural Failures
- Electrical Safety
- Energy Control – Lockout Tag Out
- Tools and Machines
- Chemicals
- Toxicology
- Confined Space Entry
- ISO 18001 Safety Management Systems, Safety Plans and Programs
- Fire Protection, Explosions and Explosives
- Heat and Cold, Pressure, and Noise
- Transportation Safety
- Systems Safety

Contribution of Course to Meeting the Professional Component:
The fundamentals of hazard identification, the evaluation of risk, and the control of hazards is given. The student learns the roles and responsibilities of the engineer to eliminate and control hazards and to effectively communicate and educate management and affected employees working in an industrial environment. Safety management systems are explored and the development of safety plans and programs are investigated at local companies.

Knowledge of the fundamentals of chemistry, physics and mathematics are applied to identify and quantify potentially hazardous exposures to airborne contaminants, noise, dangerous environments, fires and explosions, heat and cold. Engineering design is necessary to develop control methods, such as shielding, guarding, fire protection systems and mechanical exhaust ventilation.

Prepared by: David L. Krack, Lecturer 12/31/2004
## ISE 114: Safety Engineering

### Contribution of Course to Program Outcomes

#### Level of Learning by Topic/Activity

<table>
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<tr>
<th>Learning Objectives:</th>
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<td>Understand Occupational Safety Concepts and Laws and Regulations</td>
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<td>Understand Worker’s Compensation Insurance</td>
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<tr>
<td>Understand and describe Product Liability</td>
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<td>Understand and apply General Principles of Hazard Control</td>
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<td>HW, Exam 1 &amp; 2</td>
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<tr>
<td>Describe and calculate Mechanics and Structural Failures</td>
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<td>Describe Electrical Safety</td>
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<td>Describe Energy Control - Lockout Tag Out</td>
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<td>Knowledge of Tools and Machines</td>
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<td>Identify hazardous Chemicals</td>
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<td>Calculate Toxicology levels and use proper equations</td>
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<td>Understand the concept of Confined Space Entry</td>
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<tr>
<td>Knowledge of ISO 18001 Safety Management Systems</td>
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<tr>
<td>Understand and be able to implement Safety Plans and Programs</td>
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<tr>
<td>Understand Fire Protection: Explosions and Explosives and be able to solve appropriate equations associated with each</td>
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<td>Understand and apply Heat and Cold, Pressure, and Noise equations and concepts</td>
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<td>Define Transportation Safety</td>
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<tr>
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**Note:** Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)
Industrial and Systems Engineering 115: Computer Integrated Manufacturing (Required)

Course Description: 3 CR. U. Analyze, design and integrate manufacturing processes with CAD/CAM technologies including numerical control, material handling and storage, group technology and computer control. Prerequisite: ME 110


Class/Laboratory Schedule: Two 50-minute lectures per week, one 3-hour lab per week

Course Objectives:
1. Learn an array of CIM technology and its manufacturing applications including CNC machining, GT cells, industrial robots and programmable controllers.
2. Learn to conceptualize and model line flow processes from single station to multiple stations including the effects of buffers.
3. Survey the components of CIM systems, CNC machines, process/MH robots, automated storage systems, transporters and process control.
4. Learn the low-level mechanisms and control of sensors, actuators, drive motors, and ADC/DAC signal converters.
5. Enhance the classroom learning through hands-on modeling, programming and equipment manipulation in the laboratory.
6. Learn to recognize what processes to automate, how the automated processes should be integrated and what technology is available to accomplish the task.

Topics Covered:
- Relationship of work-in-process volume and manufacturing lead time
- Process line modeling – Single, multiple and effects of buffers.
- Analytical storage models and optimization of line buffers.
- Part classification and process grouping for Group technology cells
- Industrial robots and pick & place control programming
- CNC machining, programming and linear control
- Survey of automated material handling systems – conveyor, AS/RS and AGV
- Sensors, actuators and ADC/DAC signal conversion
- Motor Control – stepping, encoding and pulse count
- Basics of relay ladder logic and Programmable Logic Controller
- Line integration – process machines, transporters, MH robots, buffers and controllers

Contribution of Course to Meeting the Professional Component:
This course emphasizes conceptual modeling and big-picture approach to automated flow processes prior to engaging in detailed line design work. The course provides engineering team project experience through rigorous hands on lab projects which run parallel with the material presented in lectures. An emphasis is placed on the design and application of actual computer integrated manufacturing systems. This will better prepare the student for the real world working environment.

Prepared by: Hee Man Bae
### ISE 115: Computer Integrated Manufacturing

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

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Note: Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)
Industrial and Systems Engineering 120: Work Methods Design and Measurement (Required)

Course Description: 3 CR. U.


Class/Laboratory Schedule: One 2hr lecture per week, One 3-hr lab per week

Course Objectives:
1. Ability to document work methods at appropriate level of detail
2. Understanding Principles of Motion Economy
3. Ability to conduct time study and complete computation of Allowed Time
4. Ability to utilize predetermined elemental time system
5. Ability to conduct occurrence study/work sampling study
6. Ability to conduct complete methods study at a real workplace, recommend improvements, and prepare estimate of benefits.
7. Provide team project experience
8. Provide oral and written reporting experience

Topics Covered:
- Line Balancing
- Process Charts, operation charts, therblig charts
- Principles of Motion Economy
- Ergonomics/Human Factors of Workplace Design
- Time Study
- Standard Data Systems
- Work Sampling
- Incentives/training

Contribution of Course to Meeting the Professional Component:
In this course, students are introduced to the guidelines, tools and criteria to design and develop ergonomic workplaces, environments, programs and solutions. Students learn to collect, analyze and evaluate data, develop solutions from the data, and report their results. In addition, students are taught the differences and relative strengths and weaknesses between engineering and administrative controls in ergonomics.

Students are familiarized with engineering standards such as OSHA guidelines, worker compensation laws, etc. Through relevant course work, students learn quantitative and qualitative methods for designing plant layout and material handling systems while taking into account engineering standards. In addition, the students work in small groups on real world problems dealing with plant layout, facility design, and work methods design and measurement.

Prepared by: Dr. Louis Freund
**ISE 120: Work Methods Design and Measurement**

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

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**Assessment Methods**

- HW, Test #1, #2, Final Exam, Labs
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- HW, Test #2, Final Exam, Labs
- Project, Labs
- Project
- HW Test #1, Final Exam
- HW, Test #1, Final Exam
- HW, Test #2, Final Exam, Labs
Industrial and Systems Engineering 130: Engineering Probability and Statistics (Required)

Course Description: 3 CR. U. Probability theory, graphical displays of data, graphical methods of samples and hypotheses testing. Statistical estimation and inference. Uses graphical statistical packages. Prerequisite: Math 32.


Class/Laboratory Schedule: 3 hrs, Two 75 minute lectures per week

Course Objectives:
1. To learn about descriptive statistics and graphical methods to summarize data using MiniTab (a statistical software tool) and hand calculations.
2. To understand occurrence of variance in data
3. To learn and master basic probability concepts and its use in statistical inference
4. To learn about probability distributions and cumulative distribution functions and their use in calculating probability.
5. To define and learn to identify discrete and continuous random variables.
6. To learn to calculate mean and variance of discrete and continuous random variables
7. To learn the basic concepts of statistical inference.
8. To understand and use point estimation and confidence intervals in engineering problem solving
9. To understand and use hypothesis testing in engineering problem solving
10. To learn to use linear regression for building empirical intervals in engineering and scientific data.
11. To understand how the analysis of variance is used to analyze the data collected from designed engineering experiments

Topics Covered:
- Probability; Sample Space; Events
- Conditional Probability; Independence
- Bayes Theorem
- Data Summary and Presentation
- Discrete Random Variables and Distributions
- Continuous Random Variables and Distributions
- Central Limit Theorem
- Confidence Interval
- Hypothesis Testing – Single Population
- Hypothesis Testing – Two Populations
- Linear Regression
- ANOVA

Contribution of Course to Meeting the Professional Component:
Basic knowledge of theory of probability and statistics is given. The students learn how calculus concepts are used in evaluating probabilities and problem solving. Use of probability and statistics is discussed with engineering applications.

Prepared by: Dr. Minnie Patel
ISE 130: Engineering Probability and Statistics
Contribution of Course to Program Outcomes
Level of Learning by Topic/Activity

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Industrial and Systems Engineering 131: Statistical Process Control and Improvement (Required)

Course Description: 3 CR. U. Statistical computations, sampling procedures, development and use of control charts and utilization of computerized statistical packages. Design of statistical quality control systems. The seven tools of quality; process capability studies. Prerequisites: ISE 130 (with grade of “C-” or better) or equivalent.


Class/Laboratory Schedule: Two 50-minute lectures per week, one 3-hour lab per week

Course Objectives:
1. To familiarize students with problems in quality planning and control and the terminology used to describe these problems.
2. To familiarize students with the nature inherent in the design and manufacture of products and the statistical based methods used to characterize and reduce this variation.

Topics Covered:
- History of Quality
- Cost of Quality
- Variable Control Charts
- SPC Interpretation
- Process Capability Study (Cp, Cpk)
- Attribute Control Charts
- Statistical Tolerance Charts
- Lot Sampling
- Taguchi Techniques
- Basic Tools of Quality (Pareto Charts, etc.)
- Total Quality Management
- Six-Sigma
- Gurus of Quality
- House of Quality

Contribution of Course to Meeting the Professional Component:
The students are familiarized with design of statistical process control methods for better and more predictable quality of products and processes. Students are introduced to the way of statistical thinking in the planning and management of industrial engineering functions for continuous improvement in process design and operation.

Prepared by: Dr. Yasser Dessouky
# ISE 131: Statistical Process Control and Improvement

## Contribution of Course to Program Outcomes

### Level of Learning by Topic/Activity

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Industrial and Systems Engineering 135: Design of Experiments (Required)

Course Description: 3 CR. U. Tests of composite hypothesis, analysis of variance, statistical decision theory, sampling procedures, design and implementation of statistical process control systems, response surface experimental design, Taguchi experimental design, system reliability, utilization of computerized statistical packages. Prerequisite: ISE 130 (with grade of “C-“ or better) or equivalent


Class/Laboratory Schedule: Two 75-minute lectures per week

Course Objectives:
This course is focused on providing the student with the basis of statistical evaluation of product and process in engineering systems. The course will provide the student with tools and techniques for analysis and characterization of industrial processes. The course will concentrate on “design of experiments” to assure accurate and efficient hypothesis testing and characterization. The course combines experimental design with statistical techniques to provide the student with sufficient expertise to successfully analyze and design and conduct experiments in industrial and research engineering settings. Success in the course will be demonstrated by the following competencies:

1. Determine when and how to apply statistical analysis and quality control techniques in industrial processes: these techniques will include assessment of event probabilities, estimation, and testing of means, rates, and variances of process and product.
2. Demonstrate application of descriptive and inferential statistical methods.
3. Develop and test hypothesis, and report results of analyses in an appropriately structured empirical format.
4. Interpret data and results of those analyses in relation to process and product control.

Topics Covered:
- Sampling Distributions
- Regression Models
- Variance - General Form
- ANOVA link to Regression Models
- Comparisons and Contrasts
- Non Parametric Tests
- Randomized, Balanced, and Incomplete Block Design
- Latin Square Design
- Factorials, General, Fractional and the Design of them
- Sample size Requirements and Hypothesis Testing
- Response Surface Methods
- 2(k) designs
- Measures of Goodness of Fit
- 2(n) General Form

Contribution of Course to Meeting the Professional Component:
The skills and knowledge gained in ISE 135 have immediate and direct impact on the professional capability of the systems engineer. The professional industrial and systems engineer is called upon to design and conduct experiments in response to requirements, control and optimization. This course provides methods for analyses that are consistent with the professional requirement to design experiments and apply statistical techniques for system understanding and control.

Prepared by: Kevin Corker, Professor
### ISE 135: Design of Experiments

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

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<tr>
<th>Learning Objectives</th>
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<th>Assessment Methods</th>
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<td>Knowledge of Sampling Distributions</td>
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<td>Ability to Perform Analysis of Variance General Form</td>
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<td>Understanding of ANOVA Link to Regression Models</td>
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<td>Ability to perform Comparisons and Contrasts</td>
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<td>Understanding of Randomized, Balanced, and Incomplete Block Designs</td>
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<td>Ability to conduct Latin Square Designs</td>
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<td>Understanding of Factorials, General, Fractional and the Design of them</td>
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<td>Understanding of Sample Size Requirements and Hypothesis Testing</td>
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<td>Ability to conduct measures of Goodness of Fit</td>
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**Note:** Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)
Industrial and Systems Engineering 140: Operations Planning and Control (Required)

Course Description: 3 CR. U. Design, implementation and evaluation of manufacturing, planning and control systems. Includes MRP II, ERP, JIT. Prerequisites: ISE 102, ISE 120, ISE 170


Class/Laboratory Schedule: Two 75-minute lectures per week

Course Objectives:
1. Explain problems in manufacturing planning and control and the terminology used to describe these problems
2. Apply models used in manufacturing planning and control
3. Create a detailed production plan
4. Evaluate different plans

Topics Covered:
- Production System Layout
- Forecasting
- Aggregate Production Planning
- Master Production Scheduling
- Capacity Planning
- Inventory Modeling
- Master Requirements Planning
- Scheduling
- Just-In-Time Production

Contribution of Course to Meeting the Professional Component:
This course implements the design of manufacturing operations that are subject to variable performance characteristics. Students learn the fundamentals and applications of planning models in forecasting, inventory, scheduling and the design and control of their respective systems. The emphasis in working on real-life operations is implemented through an assigned project. Working in groups of three or four, students go through a series of formulations in forecasting, aggregate planning, and scheduling using a simulation model.

Prepared by: Dr Yasser Dessouky
# ISE 140: Operations Planning and Control

## Contribution of Course to Program Outcomes

### Level of Learning by Topic/Activity

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<tr>
<td></td>
<td>To what extent did this course increase your:</td>
<td>Ability to apply knowledge of mathematics, science, and engineering</td>
<td>Ability to design a system, component, or process to meet desired needs</td>
<td>Ability to function on multi-disciplinary teams</td>
<td>Ability to apply forecasting algorithms</td>
<td>Ability to perform a aggregate plan and integrate a forecast and aggregate plan</td>
<td>Ability to perform a Master Production schedule and to integrate an aggregate plan and a production schedule</td>
<td>Ability to perform capacity planning</td>
<td>Ability to apply inventory control and lot sizing algorithms</td>
<td>Ability to perform a Material Requirement Plan</td>
<td>Ability to determine the impact of different scheduling rules on various performance measures as well as the associated costs with these plans</td>
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Industrial and Systems Engineering 151: Managing Engineering (Required)

Course Description: 3 CR. U. Broad overview of engineering management theory and practice including: management’s roles, responsibilities, skills, strategy and planning; management systems, human resource management, problem solving and decision-making; engineering practice. Prerequisite: 100W course.


Class/Laboratory Schedule: One 150-minute lecture per week.

Course Objectives:
1. To give the student an introduction and basic understanding of management and the technical management function.
2. To provide a systems view of the organization and how the engineering manager operates within that structure.
3. To give the student a historical perspective on engineering management, and contrast current management practices with those of the past.
4. To give the student exposure to the product management and project planning functions.
5. To expose the business financial environment to the student including costing methodology.
6. To breach the qualitative concept of quality and its impact on the organization.
7. To provide the student with a solid understanding for functioning within the broader technical organization, and exposure to different corporate cultures.
8. To investigate some of the legal and ethical aspects of engineering management in our society today.

Topics Covered:
- Definitions of Management
- Organizational structures
- Team building
- Business and Management Strategy Formulation
- Decision making
- Project Planning and Control
- Leadership and Motivation
- Financial Environments
- Control through costing
- Legal and Ethical Issues
- Effective Communications
- Product management, sales, and distribution

Contribution of Course to Meeting the Professional Component:
By exposing the student to management and organizational issues this course will greatly enhance one’s ability to function in real work situations, with a professional advantage. As the engineer grows, and progresses on a career path, more of the so called “soft skills” will become paramount for success. The curriculum in this course provides a starting point for that professional understanding, in addition to a path for continued life long learning for most all roles the engineer will take on in his/her profession.

Prepared by: Marc L. Komrosky, Instructor
## ISE 151: Managing Engineering

### Contribution of Course to Program Outcomes

#### Level of Learning by Topic/Activity

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### Learning Objectives:

- **Differentiate between management in general and the technical manager’s responsibilities.**
- **Identify management styles, and one’s own personality and temperament traits.**
- **Define what quality is.**
- **Define the classic organizational structures and understand the barriers to organizational change.**
- **Know how to define the elements of a corporate strategy hierarchy.**
- **Know how to use qualitative decision-making techniques.**
- **Identify an effective communications methodology and process.**
- **Plan and communicate project status through graphical means.**
- **Distinguish between the different leadership and motivational theories.**
- **Engage in teambuilding and be able to identify the stages of team development.**
- **Identify time elements, and understand time management techniques.**
- **Identify conflicts between the manager’s ethical role within the organization and one’s ethical duty to society.**

### Assessment Methods

- HW, Quiz-1
- HW, MBTI Assignment
- HW, Class Discussion
- HW, Quiz-2, MidTerm
- HW, MidTerm
- HW, Class Discussion, MidTerm
- HW, Project, Case Study Presentations
- HW, Project
- HW, Quiz-3
- Project, MidTerm
- HW, Class Discussion
- Ethics Paper, Quiz-4

Note: Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)

C-77
Industrial and Systems Engineering 155: Supply Chain Engineering (Technical Elective)

Course Description: 3 CR. U. A comprehensive coverage of supply chain topics; real world applications including logistics, inventory management, risk pooling, value of information, strategic alliance, procurement and outsourcing strategies, information technology, coordinated product and supply chain design, customer value, decision support systems. Prerequisites: ISE 140


Class/Laboratory Schedule: Two 75-minute lectures per week

Course Objectives:
Upon completion of this course, students will:
1. be familiar with the supply chain topics
2. understand the key issues in supply chain management
3. gain knowledge in distribution network configuration
4. learn the role of inventory control and demand forecasting in the supply chain
5. understand relationships between buyers and suppliers
6. learn distribution strategies in supply chain
7. understand supply chain integration and strategic partnering
8. learn outsourcing and procurement strategies in supply chain
9. know the role of product design in supply chain
10. know information technology as a critical enabler of effective supply chain management
11. understand the concept of customer value

Topics Covered:
- The Supply Chain is in general terms.
- Supply Chain and the channels within it, and the Logistics function.
- Packaging and the effect on overall supply chain and logistics channel
- Facilities Management
- Unitization and unit load and its influence on transport mode and method
- Value chain as applied to the Supply Chain
- Outsourcing and 3PLs
- Information and customer value within the supply chain
- Inventory and the Logistic function for Supply Chain design.
- Materials handling and logistics integration
- Supply Chain tools – mathematical and analytical
- Push-Pull systems and Push-Pull boundaries
- Bullwhip Effect

Contribution of Course to Meeting the Professional Component:
The combination of qualitative concepts with significant quantitative content including software tool use, graphic, and manual mathematical techniques serves to reinforce the student’s learning, understanding, and application of math and science content specifically for the outside engineering world.

Prepared by: Marc L. Komrosky, Instructor
**ISE 155: Supply Chain Engineering**

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

<table>
<thead>
<tr>
<th>Learning Objectives:</th>
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<th>Assessment Methods</th>
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<tbody>
<tr>
<td>Define what a Supply Chain is in general terms.</td>
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<tr>
<td>Differentiate between the Supply Chain, the channels within it, and the Logistics function.</td>
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<tr>
<td>Explain how packaging influences the overall supply chain and logistics channel.</td>
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<td>HW, Quiz-2, MidTerm</td>
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<td>Apply simple algorithms or models to determine where distribution centers or warehouses, and other facilities can be optimally located.</td>
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<td>HW, Class Demonstration</td>
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<td>Know how to apply unitization, and how unit load influences transport mode and method.</td>
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<td>HW, Quiz-2, MidTerm</td>
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<td>Understand the value chain concept as applied to the Supply Chain.</td>
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<td>Describe what benefits there are to outsourcing and engaging a 3PL provider.</td>
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<td>Understand the importance of information to customer value within the supply chain.</td>
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<td>Show how inventory affects the Logistic function and Supply Chain design.</td>
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<td>Generalize on how materials handling and logistics integrate.</td>
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<td>Apply mathematical and other analytical tools to optimize and improve the Supply Chain.</td>
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<td>HW, Class Demonstration</td>
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<td>Distinguish between Push-Pull systems and determine where a Push-Pull boundary can be effective.</td>
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<td>Explain the Bullwhip Effect</td>
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Industrial and Systems Engineering 164: Computer and Human Interaction
(Technical Elective)

Course Description: 3 CR. U. Introduction to human/computer interaction, paradigms for interaction, human performance capabilities, computer input/output device analysis and design, pattern recognition 3D audio, 3D visualization, application to virtual reality and multimedia. Prerequisites: Engr 100W, ISE 130


Class/Laboratory Schedule: Two 75-minute lectures per week

Course Objectives:
The course will provide a theoretical and practical structure for the design, implementation and evaluation of human-computer interaction processes. It will examine theory and techniques to support graphical use interfaces, command input devices (including virtual environments, distributed coordinated work and cybernetic interfaces). It will introduce the concept of user-centered design and discuss methods for human computer interaction (HCI) evaluation and assessment. The course will be divided into three components. The first will address human capabilities and limitations in interaction with computer systems. The second will cover human computer interaction in information retrieval and use in domain of work. The third part of the course will explore extended and advanced human computer interface concepts, including cyborg design. The hardware or the GUI will be covered in so far as it presents fundamental constraints or provides fundamental capabilities. Human Computer Interface evaluation techniques will be explored throughout the course and a summary of those will be provided in the final class meetings.

Topics Covered:
- Visual Perception of Design
- Manual Input & Predictive Models
- Introduction to Information Processing
- Web Interface Design
- Information Processing and GOMS
- Mental Models
- Displaying Information & Guiding Search
  - Navigation
- Virtual Environments & Information Visualization
- Cognitive Work Analysis
- Computer Supported Cooperative Work
- Human-Cyborg Design & Perceptual/Motor Cyborgs

Contribution of Course to Meeting the Professional Component:
The student in class are introduced to the state-of-the-art in user interface design both by interacting with actual interfaces or by interaction with functional analog’s of these real interfaces. The student’s design topics are required to be associated with real world human-computer interaction requirements. The student’s are further required to analyze the world infrastructural requirement to support their interface designs.

Prepared by: Kevin Corker, Professor
### ISE 164: Computer and Human Interaction

**Contribution of Course to Program Outcomes**

#### Level of Learning by Topic/Activity

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Note: Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.}

---

**Learning Objectives:**

- Understanding of Characteristics of Humans as they interact with computers
- Understanding Human sensory and perceptual process
- Knowledge of the Human cognitive processes
- Ability to apply techniques of human interaction with automation
- Ability to design Processes for HCI
- Ability to create User-Centered Design
- Understanding of Interface Structures (dialogue, error messages, help messages, etc.)
- Application of Direct Manipulation Interfaces
- Understanding of Natural Language Interface
- Ability to interpret and design Virtual Environments
- Understanding of Computer Supported Cooperative Work
- Application of Interface Evaluation Techniques
- Knowledge of Information Technology Impact and its impact of Society

**Assessment Methods**

- Exam & Project
- Exam
- Class Discussions
Industrial and Systems Engineering 167: System Simulation (Required)

Course Description: 3 CR. U. Introduction to simulation. Monte Carlo techniques. Design and use of discrete-event computer simulation modeling techniques; theoretical and practical treatment of input to models; model validation methods and output analysis. Synchronized sampling, model comparisons. Prerequisites: CmpE 46; ISE 130 (with grade of “C-“ or better); ISE 170.


Class/Laboratory Schedule: Two 50-minute lectures per week, one 3-hour lab per week

Course Objectives:
1. Compare and contrast simulation with analytic and statistical modeling approaches
2. Prepare the steps of a simulation study
3. Construct simulation programs in the simulation language (ProModel)
4. Analyze process data and select an appropriate distribution to model a process
5. Design appropriate statistical techniques to analyze the output from simulation experiments
6. Generate pseudorandom numbers and to use them to generate random variables from several common theoretical distributions

Topics Covered:
- Components of Simulation System (Entities, Resources, etc.)
- World Views and Event Scheduling
- Components of Simulation Study (Validation, Verification, etc.)
- Use of ProModel Simulation Package
- Input Data Analysis (Chi-Squared and KS Test)
- Output Analysis of a Single System
- Comparing the Output of Two Systems
- Random Number Generation
- Random Variable Generation

Contribution of Course to Meeting the Professional Component:
Complex real systems design and analysis is taught in this class through the use of computer simulation. The computer simulation tool ProModel is used to model basic manufacturing systems for their design and analysis. Students work on a major class project that generally deals with a real world scenario for modeling and analysis.

Prepared by: Dr. Yasser Dessouky
# ISE 167: System Simulation

## Contribution of Course to Program Outcomes

### Level of Learning by Topic/Activity

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<tr>
<th>Q#</th>
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<table>
<thead>
<tr>
<th>Learning Objectives:</th>
<th>Assessment Methods</th>
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</thead>
<tbody>
<tr>
<td>To what extent did this course have an impact on your learning?</td>
<td></td>
</tr>
<tr>
<td>Ability to apply knowledge of mathematics, science, and engineering</td>
<td>HW, Labs, Project</td>
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<tr>
<td>Ability to design and conduct experiments, as well as to analyze data and interpret results</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Ability to design a system, component, or process to meet specified needs</td>
<td>HW, Labs, Project</td>
</tr>
<tr>
<td>Ability to function on multidisciplinary teams</td>
<td>HW, Labs, Final</td>
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<tr>
<td>Ability to identify, formulate, and solve engineering problems</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Understanding of professional and ethical responsibilities</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Ability to communicate effectively</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Understanding of the impact of engineering solutions in a global/societal context</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Recognition of the need for, and an ability to engage in lifelong learning</td>
<td>HW, Labs, Final</td>
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<tr>
<td>Knowledge of contemporary issues</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice</td>
<td>HW, Labs, Final</td>
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<tr>
<td>Ability to understand when to use simulation versus an analytic model</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Ability to understand the concepts in discrete-event simulation including world views and event-scheduling</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Ability to identify the steps and components of a simulation study</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Write simulation programs in the simulation language (ProModel)</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Understanding data collection and parameter estimation and the use of input data analysis</td>
<td>HW, Labs, Final</td>
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<tr>
<td>Ability to perform confidence intervals for steady state and terminating simulations for output analysis</td>
<td>HW, Labs, Final</td>
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<tr>
<td>Ability to perform goodness of fit tests</td>
<td>HW, Labs, Final</td>
</tr>
<tr>
<td>Ability to generate pseudorandom numbers</td>
<td>HW, Final</td>
</tr>
<tr>
<td>Ability to generate random number variables from various distributions</td>
<td>HW, Final</td>
</tr>
<tr>
<td>Ability to work in teams effectively</td>
<td>HW, Final</td>
</tr>
<tr>
<td>Ability to prepare written reports</td>
<td>HW, Final</td>
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</tbody>
</table>

Note: Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)
Industrial and Systems Engineering 170: Operations Research (Required)

Course Description: 3 CR. U. Development and application of mathematical models to industrial problems. Linear programming, network analysis, Markov models, game theory, queuing theory and decision analysis. Prerequisites: ISE 130 (with grade of “C-” or better).

Pre/Corequisite: Math 129A


Class/Laboratory Schedule: Two 75-minute lectures per week

Course Objectives:
To study the mathematical techniques on operations research (OR) and their applications to problems related to industrial and systems engineering; to learn the use of software in solving OR problems. When the course is completed, the student should be able to formulate a variety of real-world quantitative decision-making problems as OR problems and apply OR techniques to solve them. In this course, developing “guided intuition” is as important as understanding mathematical rigor.

Topics Covered:
- Introduction to Linear Programming
- Simplex Method – Geometric and Economic Motivation
- Simplex Method – The Algorithm and Rationale
- Simplex Method – Meanings of Tableau Elements
- Linear Programming – Shadow Price as Effective Price or Profit
- Transportation Problem and Assignment Problem
- Network Analysis – Shortest Path
- Network Analysis – Maximum Flow and Minimum Spanning Tree
- Project Management – Critical Path Method and PERT
- Markov Chains
- Poisson Process and Exponential Distribution
- Queuing Theory – Embedded Markov Chain and Flow Balancing
- Basic Queuing Systems and Applications

Contribution of Course to Meeting the Professional Component:
This course focuses on mathematical formulation of problems and development of mathematical algorithms to seek optimal solutions in the context of systems analysis and design. Students learn to develop mathematical models and find optimal solutions for systems such as production, transportation, logistics and service.

Prepared by: Dr Jacob Tsao
## ISE 170: Operations Research

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

<table>
<thead>
<tr>
<th>Q#</th>
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<th>Assessment Methods</th>
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</table>

### Learning Objectives:

1. Define Linear Programming
2. Describe Simplex Method - Geometric & Economic Motivation
3. Describe and Show the Simplex Method - The Algorithm & Rationale
4. Examine and Interpret the Simplex Method - Meanings of Tableau Elements
5. Describe and Show Linear Programming - Shadow Price as Effective Price or Profit
6. Formulate and solve Transportation Problems and Assignment Problems
7. Formulate and Solve Network Analysis - Shortest Path
8. Formulate and solve Network Analysis - Maximum Flow and Minimum Spanning Tree
9. Formulate and Solve Project Management - Critical Path Method and PERT
10. Describe, show, formulate and solve Markov Chains
11. Describe, show, formulate and solve Poisson Process and Exponential Distribution
12. Describe, show, formulate and solve Queueing Theory - Embedded Markov Chain and Flow Ballancing
13. Analyze, formulate and solve Basic Queueing Systems and Applications

**Note:** Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic).
**Industrial and Systems Engineering 195A: Senior Industrial Design I (Required)**

**Course Description:** 1 CR. U. Individual or group design projects. Proposal preparation with plans and specifications. Oral and written reports. Professional seminars. Prerequisite: ISE 105, ISE 120, ISE 170, Engr. 100W, major form on file and senior standing. Misc/Lab: Lab 3 hours.

**Textbook:** None.

**Class/Laboratory Schedule:** One 150-minute lab per week.

**Course Objectives:**
9. To develop and support teamwork skills.
10. To demonstrate topical research skills.
11. To formulate formal presentations and use convincing communications techniques.
12. To generalize on contemporary topics in the engineering field.
13. To explain specific industrial engineering topics important to field.
14. To discriminate between some of the legal and ethical aspects of engineering in our society today.
15. To apply initial design paper requirements, make a senior project topic selection.

**Topics Covered:**
- Teamwork and team building
- Effective Communications in general
- Verbal presentation methods
- Visual Presentation effectiveness with MS PowerPoint
- Creative (technical) Ideas brainstorming procedure
- Engineering Legal and Ethical Issues
- Video Series Briefs on:
  - Supply Chain Management
  - Theory of Constraints
  - Value Stream Mapping
  - JIT Manufacturing
  - How a Factory Works
  - Design and Manufacture of a Washing Machine
  - Professional Ethics and Engineering

**Contribution of Course to Meeting the Professional Component:**

By requiring the student to work in teams, and make formal topic presentations, this course will greatly enhance one’s ability to function in real work situations, with a professional advantage. As the engineer grows, and progresses on a career path, more of the so called “soft skills” will become paramount for success. The curriculum in this course provides a starting point for that sort of professional work ethic, in addition to an understanding for continued life long learning for most all roles the engineer will take on in his/her profession.

**Prepared by: Marc L. Komrosky, Instructor**
## ISE 195B: Senior Industrial Engineering Design II

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

<table>
<thead>
<tr>
<th>Learning Objectives:</th>
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<tr>
<td>1. To develop and support teamwork skills.</td>
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<td>2. To demonstrate topical research skills.</td>
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<td>3. To formulate formal presentations and use convincing communications techniques.</td>
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<td>4. To generalize on contemporary topics in the engineering field.</td>
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<td>5. To explain specific industrial engineering topics important to field.</td>
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<td>6. To discriminate between some of the legal and ethical aspects of engineering in our society today.</td>
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<tr>
<td>7. To apply initial design paper requirements, make a senior project topic selection.</td>
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### Assessment Methods

- Teamwork Presentation, Instructor feedback, Presentations-1,2, Reports and Plan for Senior design project.
- Weekly Instructor meeting, Presentations Critique Form.
- Presentations-1,2 Report and Plan for Senior design project.
- Symposium Attendance.
- Presentation Research, Video Series, Class Discussion.
- Ethics Assignment, Video Series, Summary, Class Discussion.
- Report and Plan for Senior project report.

Note: Values represent estimated impacts/effects of each course learning objective on each program outcome. These are rated on the scale of 0 – 5 (representing zero to high correlation of each targeted outcome with each course topic.)
Industrial and Systems Engineering 195B: Senior Industrial Engineering Design II (Required)

Course Description: 3 CR. U. Design of a complete industrial system including quality function deployment, technology trends, financial analysis, functional specifications, process design, production capability, quality management, manufacturing resource planning, equipment requirements, human resource management, management information systems, facility design, and project management. Prerequisites: IE 140 and ISE 195A (with grade of “C” or better). Misc/Lab: Lab 9 hours.


Class/Laboratory Schedule: One 45 – 60 min team meeting with professor per week.

Course Objectives:
This course is designed to integrate material covered in all ISE courses into a capstone senior design project. Students will develop an understanding of the principles, components, and processes of designing a complete product or process and the facility, resources, and organizational elements necessary to produce it.

Topics Covered:
- quality function deployment,
- technology trends
- financial analysis
- functional specifications
- process design
- production capability
- quality management
- manufacturing resource planning
- equipment requirements
- human resource management
- management information systems
- facility design
- project management

Contribution of Course to Meeting the Professional Component:
Complex real systems design and analysis is taught in this class through research, team processes, evaluation and presentations. Students work with simulation, experimental design, linear programming, and other quantitative modeling techniques to resolve design questions and options. Professional presentation and report is prepared to provide comprehensive discussion of project goals and results in each area of investigation.

Prepared by: Dr. Louis Freund
**ISE 195B: Senior Industrial Engineering Design II**

**Contribution of Course to Program Outcomes**

**Level of Learning by Topic/Activity**

<table>
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<tr>
<th>Project Component</th>
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<td><strong>Market Research</strong></td>
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<td><strong>Senior Exit Exam</strong></td>
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Mapping of GE Objectives to ABET Outcomes
<table>
<thead>
<tr>
<th>ABET Outcome</th>
<th>GE Area</th>
<th>Learning Objectives</th>
</tr>
</thead>
</table>
| (g) an ability to communicate effectively | A1 | Students will be able to:  
- compose and deliver extemporaneous public presentations on socially significant and intellectually challenging topics;  
- engage in critical and analytical listening;  
- analyze audiences and adapt oral presentations to audiences; and  
- assume the ethical responsibilities of the public speaker. |
| A2 | Students shall write complete essays that demonstrate the ability to:  
- perform effectively the essential steps in the writing process (prewriting, organizing, composing, revising, and editing);  
- express (explain, analyze, develop, and criticize) ideas effectively;  
- use correct grammar (syntax, mechanics, and citation of sources) at a college level of sophistication; and  
- write for different audiences. |
| C3 | Students shall write complete essays that demonstrate the ability to:  
- refine the competencies established in Written Communication 1A;  
- use (locate, analyze, and evaluate) supporting materials, including independent library research;  
- synthesize ideas encountered in multiple readings; and  
- construct effective arguments. |
| Z | Students shall be able to:  
- refine the competencies established in Written Communication 1A and 1B;  
- express (explain, analyze, develop, and criticize) ideas effectively, including ideas encountered in multiple readings and expressed in different forms of discourse; and  
- organize and develop essays and documents for both professional and general audiences, including appropriate editorial standards for citing primary and secondary sources. |
<p>| (h) the broad education | B1 | Students should be able to: |</p>
<table>
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<tr>
<th>necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context</th>
<th>B2</th>
<th>• use the methods of science and knowledge derived from current scientific inquiry in life or physical science to question existing explanations; • demonstrate ways in which science influences and is influenced by complex societies, including political and moral issues</th>
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<tr>
<td>Arts courses will enable students to: • recognize aesthetic qualities and processes that characterize works of the human intellect and imagination; • respond to works of art both analytically (in writing) and affectively (in writing or through other forms of personal and artistic expression)</td>
<td>C1</td>
<td>Letters courses will enable students to: • recognize how significant works illuminate enduring human concerns; • respond to such works by writing both research-based critical analyses and personal responses</td>
</tr>
<tr>
<td>Students will be able to: • place contemporary developments in cultural, historical, environmental, and spatial contexts; • evaluate social science information, draw on different points of view, and formulate applications appropriate to contemporary social issues. • apply multidisciplinary material to a topic relevant to policy and social action at the local, national, and/or international levels.</td>
<td>D1, D2, D3</td>
<td>Within the particular scientific content of the course, a student should be able to: • demonstrate an understanding of the methods and limits of scientific investigation; • distinguish science from pseudo-science; and • apply a scientific approach to answer questions about the earth and environment.</td>
</tr>
<tr>
<td>Students shall be able to: • compare systematically the ideas, values, images, cultural artifacts, economic structures, technological developments, or attitudes of people from different societies; • identify the historical context of ideas and cultural practices and their dynamic relations to other historical contexts; and • explain how a culture changes in response to internal and external pressures.</td>
<td>V</td>
<td>(i) a recognition of the B1, Students should be able to:</td>
</tr>
</tbody>
</table>
**B2**

- use the methods of science and knowledge derived from current scientific inquiry in life or physical science to question existing explanations;
- demonstrate ways in which science influences and is influenced by complex societies, including political and moral issues; and
- recognize methods of science, in which quantitative, analytical reasoning techniques are used.

**B4**

The mathematical concepts course should prepare the student to:
- use mathematical methods to solve quantitative problems, including those presented in verbal form;
- demonstrate the ability to use mathematics to solve real life problems; and
- arrive at conclusions based on numerical and graphical data.

**C3**

Students shall write complete essays that demonstrate the ability to:
- use (locate, analyze, and evaluate) supporting materials, including independent library research;
- synthesize ideas encountered in multiple readings; and
- construct effective arguments.

**E**

Students shall:
- recognize the interrelation of the physiological, social/cultural, and psychological factors on their development across the lifespan;
- use appropriate social skills to enhance learning and develop positive interpersonal relationships with diverse groups and individuals; and

**Z**

Students shall write complete essays that demonstrate college-level proficiency. Students shall be able to:
- refine the competencies established in Written Communication IA and IB (see pages 12 & 21);
- express (explain, analyze, develop, and criticize) ideas effectively, including ideas encountered in multiple readings and expressed in different forms of discourse; and
- organize and develop essays and documents for both professional and general audiences, including appropriate editorial standards for citing primary and secondary sources.

(j) a knowledge of contemporary issues

**D1, D2**

Students will be able to:
- place contemporary developments in cultural,
| D3 | historical, environmental, and spatial contexts; 
|    | • evaluate social science information, draw on different points of view, and formulate applications appropriate to contemporary social issues. 
|    | • apply multidisciplinary material to a topic relevant to policy and social action at the local, national, and/or international levels. |
MS-ISE Program Orientation Material
AGENDA:
- Welcome
- Graduate Standing
- Degree Requirements
- Course Description
- Course Scheduling
- Faculty
- Advancement Procedure
- Financial Aid
- Job Market and Career Prospects
- Preparation for Possible Admission To Ph.D. Programs Elsewhere
- Miscellaneous

YOUR POSSIBLE CURRENT GRADUATE STANDING
- (Unconditionally) Classified
- Conditionally classified: Prerequisites
- Provisionally Admitted: Submit missing official documents to GS&R.

DEGREE REQUIREMENTS
- Prerequisites, if Applicable
- Course Requirements (See Attachment A.)
- Competency in Written English (See Attachment B.) - Five ways to satisfy this requirement:
  - If you have completed a “100W (Technical Writing Course)” at any Cal State University, you have already satisfied the requirement.
- Pass Writing Skill Test (WST) to become eligible for 200W at SJSU (or 100w) and then pass 200W (or 100W). If you pass WST with a sufficiently high score, you will get a waiver for 200W (or 100W).
- If you are the sole author of a paper published in a peer-reviewed journal or conference proceedings, send a petition letter to the Office of Graduate Studies and Research of SJSU with all supporting documents for approval.
- If you have completed a course equivalent to SJSU 100W at another university, petition to the Office of Graduate Studies and Research (GS&R), with all supporting documents, for the approval by the Associate Vice President of GS&R.
- Pass either ISE 220 or ISE 212. 30% or more of the grade for either course depends exclusively on your writing skills. In the case of ISE 220, 50% of the grade depends exclusively on the final report of the course. (30% is allocated exclusively to the writing while the other 20% is allocated to the technical substance.) An instructor for technical writing alone will evaluate your writing skills based on the final report and will assign your score for the writing component of the course grade, i.e., for the 30%; the instructor of ISE 220 will be responsible for your score for the other 70%.

**COURSE DESCRIPTION (See Attachment C for details.)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISE 200</td>
<td>Financial Methods in Engineering</td>
</tr>
<tr>
<td>ISE 201</td>
<td>Engineering Analysis (Service Course for MSE)</td>
</tr>
<tr>
<td>ISE 202</td>
<td>Design and Analysis of Engineering Experiments</td>
</tr>
<tr>
<td>ISE 210</td>
<td>Human Factors/Ergonomics</td>
</tr>
<tr>
<td>ISE 212</td>
<td>Human Factors Experiments</td>
</tr>
<tr>
<td>ISE 215</td>
<td>Usability Engineering</td>
</tr>
<tr>
<td>ISE 217</td>
<td>Human Computer Interaction</td>
</tr>
<tr>
<td>ISE 219</td>
<td>Research in Human Computer Interaction</td>
</tr>
<tr>
<td>ISE 222</td>
<td>Advanced Systems Engineering = ENGR 202</td>
</tr>
<tr>
<td>ISE 230</td>
<td>Advanced Operations Research</td>
</tr>
<tr>
<td>ISE 235</td>
<td>Quality Assurance and Reliability</td>
</tr>
<tr>
<td>ISE 241</td>
<td>Advanced Operations Planning and Control</td>
</tr>
<tr>
<td>ISE 242</td>
<td>Advanced Service-Sector ISE</td>
</tr>
<tr>
<td>ISE 245</td>
<td>Advanced Supply Chain Engineering</td>
</tr>
<tr>
<td>ISE 247</td>
<td>Logistics for Supply Chain</td>
</tr>
<tr>
<td>ISE 250</td>
<td>Organizational Improvement Capabilities and Skills</td>
</tr>
<tr>
<td>ISE 251</td>
<td>Leading Organizational Improvement</td>
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<td>ISE 265</td>
<td>Advanced System Simulation</td>
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<td>Course Code</td>
<td>Course Title</td>
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<tr>
<td>------------</td>
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<td>ISE 270</td>
<td>Information Engineering</td>
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<tr>
<td>ISE 296G</td>
<td>Cognitive Engineering</td>
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<tr>
<td>ISE 297</td>
<td>Special Topics in Industrial Engineering</td>
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<tr>
<td>ISE 298</td>
<td>Special Problems (Master’s Project)</td>
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<td>ISE 299</td>
<td>Master’s Thesis</td>
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**COURSE SCHEDULING: AN ANNUAL CYCLE**

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<tr>
<td>ISE 130</td>
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<td>ISE 202</td>
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<td>ISE 215</td>
<td>ISE 217</td>
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<tr>
<td>ISE 220</td>
<td>ISE 222* (=ENGR 202)</td>
</tr>
<tr>
<td>ISE 222* (=ENGR 202)</td>
<td>ISE 250</td>
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<td>ISE 235</td>
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</tr>
<tr>
<td>ISE 298</td>
<td>ISE 298</td>
</tr>
<tr>
<td>ISE 299</td>
<td>ISE 299</td>
</tr>
</tbody>
</table>

**SUMMER**

ISE 241

* ISE 222 is equivalent to ENGR 202, which is offered by General Engineering (i.e., the MS in Engineering Program or the MSE Program); look for ENGR 202 in the class schedule under General Engineering. If you wish to take ISE 222, register for ENGR 202 instead.
## FACULTY

### Full-Time Faculty of the ISE Department – All Tenured

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Ph.D.-Granting Institution</th>
<th>Date of Hire</th>
<th>Areas of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Louis Freund</td>
<td>Professor (Chair; on Sabbatical)</td>
<td>Ph.D. in IE; U. Michigan</td>
<td>August 1986</td>
<td>Ergonomics, Work Measurement, Engineering Economics</td>
</tr>
<tr>
<td>Minnie Patel</td>
<td>Associate Professor</td>
<td>Ph.D. in ISE; Georgia Tech</td>
<td>August 2002</td>
<td>Applied Statistics, Operations Research</td>
</tr>
<tr>
<td>Jacob Tsao</td>
<td>Professor</td>
<td>Ph.D. in OR; UC Berkeley</td>
<td>August 1999</td>
<td>Operations Research, Statistical Process Improvement, Intelligent Transportation Systems</td>
</tr>
<tr>
<td>Ernest Unwin</td>
<td>Professor (Retired)</td>
<td>Ph.D. in IE; U. Arizona</td>
<td>August 1975</td>
<td>Operations Research, Statistics, Quality Assurance</td>
</tr>
</tbody>
</table>
ADVANCEMENT PROCEDURE (All the required forms are attached; all the SJSU forms can also be downloaded from http://www.sjsu.edu/gradstudies/Current/Index.html)

- **Check-List (Required):** Fill out the MS-ISE Graduate-Status Check-List as much as you can; continue to update it as you make progress toward the MS degree. (The form is attached.)

- **Credit Transfer, if Applicable:** Fill out a form in order to petition for transfer of credit earned outside of the MS-ISE Program, either at other accredited M.S. programs or at the SJSU ISE Department but prior to admission to the SJSU MS-ISE Program. For the former case, use the form entitled Request for Validation of Transfer Credit; for the latter case, use the form entitled Request for Award of Graduate Credit for Units Completed as Undergraduate at SJSU. (The forms are attached.)

- **Change of Classification, if Applicable:** Fill out the form entitled Change of Classification in Master’s Program and obtain approval from the Graduate Advisor, if you were admitted conditionally with prerequisites imposed and when all the prerequisites are completed satisfactorily. (The form is attached.)

- **Advancement to Candidacy of Master’s Degree (Required)**
  - **Conditions**
    - Completion of a minimum of 9 units of graduate work.
    - GPA for all SJSU courses taken after the bachelor’s degree must be at least 3.0; lower-division courses are not included in the computation. GPA for all the 200-level ISE courses that have been taken and are constituent courses of the student’s MS-ISE Program at SJSU must be at least 3.0.
    - Satisfaction of the Requirement of Competency in Written English, which is also called the Graduate Writing Assessment Requirement (GWAR).
  - **Actions:**
    - Fill out the form entitled MS-ISE Request for GRADUATE STUDIES AND RESEARCH to Determine Equivalence of Non-CSU Technical-Writing Course(s) to 100W, if applicable. (The form is attached.)
    - Fill out the required form entitled Departmental Request for Candidacy and Graduate Degree Program and obtain approval from the Graduate Advisor. (The form is attached.)
    - Fill out the formed entitled Request for Course Substitution in Master’s Degree Program if you have submitted an approved Departmental Request for Candidacy and Graduate Degree Program but have since decided to change the Program. Obtain approval from the Graduate Advisor. (The form is attached.)
  - **Note:** The Office of Graduate Studies and Research requires that this form (i.e., Departmental Request for Candidacy and Graduate Degree Program) be submitted at least nine months before planned graduation date. In other words, there is a 9-month lead time between the filing of the form and the award of the MS degree.

- **Application for Completing the Culminating Experience: a Master’s Project or Master’s Thesis (Required):** Fill out the form entitled ISE 298 Registration and Approval Form to obtain a permission code and then use the code to register for the M.S. Project or the
form entitled ISE 299 Master’s Thesis Registration and Approval Form to register to obtain a permission code and then use the code to register for the M.S. Thesis, depending on your choice. Follow the instructions detailed on the forms. (The form is attached.)

- **Application for Internship Credit by International Students, if Applicable**: Fill out the form entitled ISE 298 Registration and Approval Form to obtain a permission code and use it to register ISE 298 of an appropriate number of units. (The form is attached.) Note that the Homeland Security Department of the U.S. Government requires that any internship for an international student must be part of the MS Program, the student must earn graduate credit, and the credit earned must count toward the degree. The internship credit units earned by an international student of the MS-ISE Program must sum up exactly to three at graduation. The international student must complete an M.S. Project or M.S. Thesis like any other MS-ISE Student before an M.S. degree in ISE can be awarded to the student. The M.S. Project completed by an international student who registers at least a 1-unit ISE 298 may or may not result from the student’s internship work.

- **Application for Graduation (Required)**: Fill out the form entitled Application for Award of Master’s Degree. (The form is attached.)

- **Request for a Change in Graduation Date, if Applicable**: If you have submitted an Application for Award of Master’s Degree but need to change the graduation date, fill out the form entitled Graduation date Change Request for Award of Master’s Degree. (The form is attached.)

- **Change of Grade from I (Incomplete) to CR (Credit) for the M.S. Project (ISE 298) or M.S. Thesis (ISE 299), if Applicable**: If the Culminating Experience (i.e., the M.S. Project or the M.S. Thesis) is not completed at the end of the semester in which the student registered for it, he or she will receive an “I” (i.e., Incomplete) as the grade for that course. The student has one calendar year to complete the Culminating Experience, without the need to register and pay for the course again, starting from the first day of the semester of enrollment. However, if the Experience is not completed with one calendar-year, the student will be required to register and pay for a 2-unit special-session ISE 298, for each and every semester or summer afterwards in which the student receives any advising about the Experience. The “I” will be changed to “CR” (i.e., Credit) if and when the Experience is completed and a Student Grade Update Form has been submitted and approved within one calendar-year of receiving the “I”. Otherwise, the “I” will be changed to an “F” (i.e., Failure) one calendar-year after receiving the grade of “I”. When the Experience is completed, the student will receive a “CR” (i.e., “Credit”) as the grade for all the ISE 298 courses related to the Experience. Fill out a Student Grade Update Form for each and every “I” or “F” received for the Experience; obtain approval from the Graduate Advisor. (The form is attached.)

- **Verification of Culminating Experience**: Fill out the form entitled Verification of Culminating Experience and obtain approval from the Graduate Advisor. (The form is attached.)

- **Procedure for Courses that Exceed the Seven-Year Time Limit**: You have seven years to complete the MS-ISE degree. A completed course becomes obsolete for a Master’s Degree at SJSU after seven years of completion. Following determination that the seven-year time limit has elapsed for one or more courses, the student should immediately contact his/her graduate advisor and fill out the form entitled Seven-Year Time Limit Options/Revalidation Request Form for every obsolete courses. (The form is attached.)
FINANCIAL AID

- A small number of TA and RA positions within ISE.
- TA, reader, lab assistant, tutor opportunities across campus
- Internship opportunities off campus
- Curriculum Practical Training in an IE position for international students after 9 months of IE study at SJSU or any another accredited university in the U.S.

JOB MARKET AND CAREER PROSPECTS

Positions include:
- Industrial Engineers
- Manufacturing Engineers
- Process Engineers
- Systems Engineers
- Quality Engineers

Responsibilities include:
- capacity planning
- process simulation studies
- distribution technologies
- customer support systems evaluations
- workplace ergonomic evaluations
- cost control and cost reduction
- computer integrated manufacturing systems
- process quality control
- facilities planning
- warehouse planning and logistics management
- product line management
PREPARATION FOR POSSIBLE ADMISSION TO PH.D. PROGRAMS ELSEWHERE

- Some recent successes
- Collaborative Ph.D. Program with the University of Pittsburgh and Mississippi State University
- M.S. thesis option vs. M.S. project
- Research

MISCELLANEOUS

- Faculty Office Hours

ATTACHMENT A

SJSU - ISE Graduate Program: Course Requirements
A 10-course (5+4+1) Evening Program with Four Specialty Areas

TWO CORE PREREQUISITES OR EQUIVALENTS, IF NOT COMPLETED ALREADY: (No Graduate Credit)

ISE 140 – Operations Planning and Control, or Equivalent
ISE 167 – System Simulation, or Equivalent

FIVE CORE COURSES

ISE 200 – Financial Methods in Engineering
ISE 210 – Human Factors/Ergonomics (including Design of Work Methods)
ISE 230 - Advanced Operations Research
ISE 235 - Quality Assurance and Reliability
ISE 298 - M.S. Project or ISE 299 – MS Thesis

FOUR SELECTED COURSES IN ONE OF FOUR SPECIALTY AREAS:

Specialty Area 1: Systems and Information Modeling (Four out of Five Courses)
ISE 270 - Information Engineering
ISE 222 – Advanced Systems Engineering
ISE 241 - Advanced Operations Planning and Control
ISE 245 – Advanced Supply Chain Engineering
ISE 265 - Advanced System Simulation
ISE 242– Advanced Service-Sector Industrial and Systems Engineering

Specialty Area 2: Production and Quality Assurance (Four out of Five)
ISE 202 – Design and Analysis of Engineering Experiments
ISE 241 - Advanced Operations Planning and Control
ISE 250 - Organizational Improvement Capabilities and Skills
ISE 245 – Advanced Supply Chain Engineering
ISE 265 - Advanced System Simulation
ISE 242 – Advanced Service-Sector Industrial and Systems Engineering
Specialty Area 3: Human Factors
ISE 202 - Design and Analysis of Engineering Experiments
ISE 212 – Human Factors Experiments

ISE 217 – Human Computer Interaction

ISE 219 – Research in Human Computer Interaction

Specialty Area 4: Supply Chain Engineering

I. Two Required Courses:
ISE 241 - Advanced Operations Planning and Control
ISE 245 – Advanced Supply Chain Engineering

II. Two out of the Following Three:
ISE 270 - Information Engineering
ISE 265 - Advanced System Simulation
ISE 242 – Advanced Service-Sector Industrial and Systems Engineering
ISE 247 – Logistics for Supply Chain

ONE ELECTIVE: One graduate ISE course in other specialty areas/See Graduate Advisor.

SJSU REQUIREMENT OF COMPETENCY IN WRITTEN ENGLISH
ATTACHMENT C

DESCRIPTION OF GRADUATE COURSES

200. Engineering Economic Analysis. A survey of current methods for the evaluation of capital investment alternatives including multiple alternative problems with finite and continuous variables; economy problems relating to systems; decisions under risk; simulated decision-making. Prerequisites: ISE 102 and ISE 105. 3 units.


210. Human Factors/Ergonomics. Analysis and evaluation of work systems in terms of the capabilities and limitations of human participants. Person as a system component. Emphasis is on evaluation of how work affects people and how people affect the work. Prerequisites: Graduate standing. 3 units.

211. Human Factors Experiments. Research and experimentation on specific aspects of the person as a system or in systems. Particular emphasis is placed on in-depth studies of unique human factors. Prerequisites: ISE 210 or instructor consent. 3 units.

215. Usability Engineering. Seminar is designed to provide students with a comprehensive overview of usability testing methods, as applied to systems products and software-web applications. Course will address testing methods, processes and marketing justification for usability testing. Prerequisites: ISE 130 or instructor consent.

217. Human Computer Interaction. Human performance characteristics, computational tools, and HCI applications. How to access/evaluate HCI requirements, to design HCI requirements, to
assess the impact of design on performance, and to generalize the design implication to system function. Prerequisites: ISE 210. 3 units.

219. **Research in Human Computer Interaction.** Concepts of Human and Computer Information Processing to support research, design and analysis of the effectiveness of human/machine systems in meeting performance objectives. Review of important and recent research in a broad range of HCI topics. Prerequisites: ISE 217. 3 units.

220. **Information Engineering.** Technologies, strategies and systems for planning, analyzing, designing and implementing data resources in order to ensure and continuously improve processes in the enterprise; object-oriented development, Computer-Aided software/Systems Engineering (CASE); information superhighway, client/server computing and distributed database management systems. Prerequisites: ISE 165 or instructor consent. 3 units.

222. **Advanced Systems Engineering.** Comparison of different kinds of systems; unique characteristics. Mathematical models for the description, analysis and design of systems. Synthesis and analysis of systems of various types. Theory of organizations, information theory and control theory applied to problems in system design. Prerequisites: ISE 130. 3 units.

223. **Advanced Operations Research.** Advanced operations research techniques and topics. Practical considerations in understanding and utilizing operations research methods. Critical analysis of case studies. Prerequisites: ISE 130. 3 units.

230. **Industrial Systems Seminar.** Familiarization with library resources and research techniques in industrial and systems engineering. The broad range of literature studies will develop the student’s ability to solve practical engineering problems in areas not previously encountered. Prerequisites: Instructor consent. 3 units.

235. **Quality Assurance and Reliability.** Selection of adequate variables to monitor a manufacturing/service process; quality improvement through process design, vendor management, customer feedback and product development; use of statistical control charts, the Pareto principle, PDCA, process capability; design for reliability, statistical techniques for analysis of reliability and reliability growth. Prerequisites: ISE 130 (or equivalent). 3 units.


241. **Advanced Operations Planning and Control.** Design, implementation and evaluation of production and service systems; manufacturing strategy, choice of processes, resources planning, production and procurement control, forecasting methods, scheduling considerations and decision-making techniques. Prerequisites: ISE 140 or instructor consent. 3 units.

245. **Advanced Supply Chain Engineering.** Supply chain concepts, strategies; emphasis on analytical tools to solve supply chain problems. Fundamentals of supply chain modeling of inventory, transportation, location, facility planning problems. Information sharing, risk pooling. Mechanisms for increasing profits. Prerequisites: ISE 140. 3 Units.

247. **Logistics for Supply Chains** An exploration of logistics for entire supply chain system from inbound movement through material management to physical distribution to customers. Topics include: packaging and handling, material management, transportation and traffic management, facility location and global logistics
250. **Organizational Improvement Capabilities and Skills.** The “what” and “why” of organizational improvement, understanding organizational improvement capabilities and human effectiveness skills, systems thinking, the Malcolm Baldrige Award, work environment and paradigm shifts, change readiness, leadership, teamwork, customer
SJSU Industrial & Systems Engineering
MS-ISE Graduate-Status Checklist

Name: _______________________________________
   (Last Name, First Name, M.I.)
Student ID #: ______________________________
Phone #: ________________________________
Cell Phone #: ______________________________

Email Address: ______________________________
Semester of First Admission: _____________________
Undergraduate Major: __________________________
From University: ________________________________
Visa status, if not US Citizen: ____________________
Additional Degrees beyond B.S.: ____________________

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<tr>
<th>30-unit Graduate Curriculum and Status-Advancement Requirements</th>
<th>Course</th>
<th>Grad. Units</th>
<th>Semester of Completion</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
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<td>Successful Completion of Prerequisites, if Applicable:</td>
<td>ISE 130</td>
<td>0</td>
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<td>“B” or better; in the semester specified in the admission letter</td>
<td>ISE 140</td>
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<td>ISE 167</td>
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<td>Request for Validation of Transfer Credit, if Applicable</td>
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<td>N/A</td>
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<td>Request for Validation of Transfer Credit, if Applicable</td>
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<tr>
<td>Satisfaction of Other Conditions, if Applicable</td>
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<td>(12 Units)</td>
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<td>(12 units)</td>
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<td></td>
<td>3</td>
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<tr>
<td>Request for GS&amp;R to Determine Satisfaction of its Requirement for Competency in Written English Already, if Applicable</td>
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<tr>
<td>Satisfaction of SJSU Requirement for Competency in Written English (AKA Technical-Writing Requirement and “GWAR”) (Required)</td>
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<td>Request for Candidacy and Approval of Graduate Degree Program (Required)</td>
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<td>Request for Course Substitution in Degree Program, if applicable</td>
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<td>Required Project/Thesis (3 units)</td>
<td>ISE 298</td>
<td>3</td>
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<td>ISE 298 S</td>
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<td>Application for Award of Master’s Degree (Required)</td>
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<td>Request for Verification of Culminating Experience (Required)</td>
<td>N/A</td>
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Note:
1. ________________________________________________________________________________________________
2. ________________________________________________________________________________________________
3. ________________________________________________________________________________________________
4. ________________________________________________________________________________________________
5. ________________________________________________________________________________________________
6. ________________________________________________________________________________________________
7. ________________________________________________________________________________________________
8. ________________________________________________________________________________________________

Certified by SJSU-MS-ISE Graduate Advisor, Dr. H.-S. Jacob Tsao, to support application for an off-campus internship (by an international student holding a valid F-1 student visa).

Signature: ________________________________________________
MS Alumni Survey Form
1. Your Name: _____________________________________ Year(s) Graduated: ____________________________
   
   Your Email Address: ______________________ Phone Number: ____________________________
   
2. ISE Dept Degree(s) Awarded:  ☐ BSISE  ☐ BSISE/Packaging Concentration  ☐ MSISE
   
3. Are you currently working as an ISE or in a related field? ☐ YES  ☐ NO. Or, a Ph.D. student?
   ☐ YES
   
4. When you graduated, were you a U.S. citizen or permanent resident? ☐ YES  ☐ NO
   
   If so, please go to Question 5 directly.
   If not, were you holding an (Please check one.)
   ☐ F-1 visa,
   ☐ H-1B visa or
   ☐ H-4 visa?
   Also, are you currently residing in the U.S.?  ☐ YES  ☐ NO
   If you were on F-1 visa and you are currently working as an ISE,
   - how long after graduation did you start a full-time job in ISE? __________
   - will or did your employer sponsor your application for an H-1 work visa?  ☐ YES  ☐ NO
   
5. Which industry are you currently working in?
   ☐ Manufacturing
   ☐ Service
   ☐ Government
   ☐ Software
   ☐ Other
   
6. Please list current and up to three previous job titles and employers starting with the most recent
ISE position you held following graduation. Please indicate industry, e.g., electronics contract
manufacturing or biomedical device manufacturing, unless it is obvious. Please indicate country if it
is not the U.S.

   e. (current position) __________________________________________________________
      __________________________________________________________ Dates: __________
f. (previous position)____________________________________________________________
__________________________________________________Dates:________________

\[\text{g. (previous position)____________________________________________________________} \]
\[\text{__________________________________________________Dates:________________} \]

\[\text{h. (first position)_______________________________________________________________} \]
\[\text{__________________________________________________Dates:________________} \]

7. List your most significant professional achievements since you graduated:

8. In the last 3-5 years, to what extent did you use the following ISE program topics. (X=time(s))

- Work measurement
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Process improvement
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Operations Planning
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Simulation
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Economic Analysis
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Human Factors
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- QA and Reliability
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Operations Research
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Information Engineering
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Design of Experiments
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
- Organ. Capability for QA
  - [ ] Not at all; [ ] 1X/2X a year; [ ] 1X/2X a quarter; [ ] 1X/2X a mo; [ ] Routinely
<table>
<thead>
<tr>
<th>Topic</th>
<th>Frequency Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Chain Engin.</td>
<td>□ Not at all; □ 1X/2X a year; □ 1X/2X a quarter; □ 1X/2X a mo; □ Routinely</td>
</tr>
<tr>
<td>Logistic</td>
<td>□ Not at all; □ 1X/2X a year; □ 1X/2X a quarter; □ 1X/2X a mo; □ Routinely</td>
</tr>
<tr>
<td>Systems Engineering</td>
<td>□ Not at all; □ 1X/2X a year; □ 1X/2X a quarter; □ 1X/2X a mo; □ Routinely</td>
</tr>
<tr>
<td>Other</td>
<td>□ 1X/2X a year ; □ 1X/2X a quarter ; □ 1X/2X a mo; □ Routinely</td>
</tr>
<tr>
<td>Other</td>
<td>□ 1X/2X a year ; □ 1X/2X a quarter ; □ 1X/2X a mo; □ Routinely</td>
</tr>
</tbody>
</table>

9. What topics/skills have you needed that we didn’t teach you?

10. What did we teach you that you wish you had understood better at the time?

11. Do you consider yourself to be an effective problem solver relative to the content of your ISE curriculum? If not, how should we have prepared you better?

12. What’s an example of a systems design challenge or other problem that you have solved for your organization? Was your solution accepted? Implemented?

13. Did the ISE program prepare you very well for your first and subsequent jobs? Why or Why not?

14. Have you taken any post graduation courses, training sessions, workshops?
   
   c. What topics?
d. Company sponsored?

15. Thanks for any thoughts or comments that will help us improve the ISE programs:
MS Employer Survey Form
Improving the Industrial and Systems Engineering Graduate Education at San Jose State University to Prepare students for a successful career in industry

**Employer Survey about M.S. Graduates**

**ABOUT YOURSELF AND YOUR ORGANIZATION**

Job Function _________________________________________________________

Company ____________________ Industry ________________________

**DESIRED SKILLS**

Please rate the importance of following skills according to your organizational needs:
(1 = not important; 5 = most important; state and rate others using the space on the right.)

- Problem Solving/Analytical Skills ______
- Leadership ______
- Technical Industrial Engineering Skills ______
  - Process Development _____
  - Time Studies and Work Measurement _____
  - Quality Control and Assurance _____
  - Production Planning _____
  - Simulation _____
  - Project Management _____
  - Operations Research _____
  - Facilities Planning _____
  - Supply Chain and Logistics _____
  - Engineering Economic Analysis _____
  - Lean Manufacturing _____
  - Six Sigma _____
- Teamwork ______
- Communications/Presentation ______

**Related Job Experience**

**CURRENT STATUS OF PERFORMANCE**

Do you have or know any employees in your organization who graduated from the graduate program in Industrial and Systems Engineering at SJSU? Yes No

If Yes, how many such employees work in your organization? _____

Based on you personal assessment, how would you rank these employees on average?
STRENGTHS AND AREAS FOR IMPROVEMENT
Based on your experience, please comment on the:

Strengths of SJSU-MS-Industrial and Systems Engineering graduates, including the skills listed above and specific technical competencies:

____________________ ____________________ ________________
____________________ ____________________ ________________

Areas for Improvement for SJSU-MS-Industrial and Systems Engineering graduates, including the skills listed above and specific technical competencies:

____________________ ____________________ ________________
____________________ ____________________ ________________

Please score the achievement of each of the following ISE Graduate Program Outcomes on a scale of 1 through 5: 1 – Not at all, 2 – Somewhat, 3 – As Expected, 4 – Above Expectation, 5 – Excellent, in reference to SJSU-ISE graduates’ performance in your company

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ability to function effectively and provide leadership within an</td>
<td></td>
</tr>
<tr>
<td>organization.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2. Ability to form, facilitate, lead, coordinate and participate in teams.</td>
<td></td>
</tr>
<tr>
<td>3. Ability to understand organizational processes and behaviors.</td>
<td></td>
</tr>
<tr>
<td>4. Student will have knowledge of methodological and computational</td>
<td></td>
</tr>
<tr>
<td>skills with which to operate effectively.</td>
<td></td>
</tr>
<tr>
<td>5. Ability to collect, analyze, and interpret data.</td>
<td></td>
</tr>
<tr>
<td>6. Ability to approach unstructured problems and to synthesize and design</td>
<td></td>
</tr>
<tr>
<td>solutions for this problem.</td>
<td></td>
</tr>
<tr>
<td>7. Ability to evaluate the impact of these solutions in the broader</td>
<td></td>
</tr>
<tr>
<td>context of the organization and society.</td>
<td></td>
</tr>
<tr>
<td>8. Ability to effectively present and sell solutions in the form of</td>
<td></td>
</tr>
<tr>
<td>written, oral and electronic media.</td>
<td></td>
</tr>
<tr>
<td>9. Ability to accomplish life-long growth within the field/profession of</td>
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<tr>
<td>ISE.</td>
<td></td>
</tr>
</tbody>
</table>

C-116
MS Project Outcome Assessment Form
Master’s Degree Project Outcome Assessment Form

Project Title: ______________________________________________________________

Student Name(s): __________________________________________________________

Please circle one for each inquiry below.

Nature of Project Topic:  (i) Research Applied   (ii) Research Theoretical
                      (iii) ISE Application  (iv) Industry-Based

Topic Area:
Work measurement
Lean Manufacturing
Operations Planning
Simulation
Economic Analysis
Human Factors
QA and Reliability
Operations Research
Information Engineering
Design of Experiments
Six Sigma
Supply Chain Engin.
Logistics
Systems Engineering

Quality of Written Presentation of the Report:

Level of Impact on Industry/Profession

Incorporated Curricular Knowledge
Yes.    No.

If no, specify in words the knowledge area used.
Please score the achievement of each of the following ISE Graduate Program Outcomes on a scale of 1 through 5: 1 – Not at all, 2 – Somewhat, 3 – As Expected, 4 – Above Expectation, 5 – Excellent, in reference to SJSU-ISE graduates’ performance in your company

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ability to function effectively and provide leadership within an organization.</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>2. Ability to form, facilitate, lead, coordinate and participate in teams.</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>3. Ability to understand organizational processes and behaviors.</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>4. Student will have knowledge of methodological and computational skills with which to operate effectively.</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>5. Ability to collect, analyze, and interpret data.</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>6. Ability to approach unstructured problems and to synthesize and design solutions for this problem.</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>7. Ability to evaluate the impact of these solutions in the broader context of the organization and society.</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>8. Ability to effectively present and sell solutions in the form of written, oral and electronic media.</td>
<td>1 2 3 4 5 NA</td>
</tr>
<tr>
<td>9. Ability to accomplish life-long growth within the field/profession of ISE.</td>
<td>1 2 3 4 5 NA</td>
</tr>
</tbody>
</table>

**Overall Rating of the project work**
MS Human Factors Employer Survey Form
Evaluating the Human Factors and Ergonomic Graduate Education at San Jose State University to Prepare Students for a Successful Career in Research and Industry

Employer Survey about M.S. Graduates

ABOUT YOURSELF AND YOUR ORGANIZATION

Job Function _________________________________________________________

Company _____________________________________ Industry ________________________

DESIRED SKILLS

Please rate the importance of following skills according to your organizational needs:
(1 = not important; 5 = most important; state and rate others using the space on the right.)

- Problem Solving/Analytical Skills ______
- Research Development ______
- Leadership ______
- Technical Human Factors Skills ______

  a. Ergonomics Evaluation ______
  b. Work Measurement ______
  c. Interface Design and Evaluation ______
  d. Human System Integration ______
  e. Simulation ______
  f. Safety Assessment ______
  g. Operations Research ______
  h. Artifact/systems Design ______
  i. Workplace Design ______
  j. Experimental Design ______
  k. Statistical Analysis ______
  l. Interpretation and Report Generation ______
  m. Cognitive Task Analysis ______

- Teamwork ______
- Communications/Presentation ______
- Related Job Experience ______
CURRENT STATUS OF PERFORMANCE

Do you have or know any employees in your organization who graduated from the graduate program in Human Factors and Ergonomics at SJSU?  Yes_____ No______

If Yes, how many such employees work in your organization?  _____

Based on you personal assessment, how would you rank these employees on average?
___1st Quartile   ___2nd Quartile   ___3rd Quartile   ___4th Quartile

STRENGTHS AND AREAS FOR IMPROVEMENT
Based on your experience, please comment on the:

Strengths of SJSU-MS- Human Factors and Ergonomics graduates, including the skills listed here and specific technical competencies:
____________________ ____________________ ________________
____________________ ____________________ ________________
____________________ ____________________ ________________

Areas for Improvement for SJSU-MS- Human Factors and Ergonomics graduates, including the skills listed here and specific technical competencies:
____________________ ____________________ ________________
____________________ ____________________ ________________
Please score the achievement of each of the following HFE Graduate Program Outcomes on a scale of 1 through 5: 1 – Not at all, 2 – Somewhat, 3 – As Expected, 4 – Above Expectation, 5 – Excellent, in reference to SJSU-ISE graduates’ performance in your company.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ability to function effectively and provide leadership within an</td>
<td></td>
</tr>
<tr>
<td>organization.</td>
<td>12345</td>
</tr>
<tr>
<td>2. Ability to form, facilitate, lead, coordinate and participate in teams.</td>
<td></td>
</tr>
<tr>
<td>3. Ability to understand organizational processes and behaviors.</td>
<td></td>
</tr>
<tr>
<td>4. Student will have knowledge of methodological and computational</td>
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<tr>
<td>skills with which to operate effectively.</td>
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</tr>
<tr>
<td>5. Ability to collect, analyze, and interpret data.</td>
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<tr>
<td>6. Ability to approach unstructured problems and to synthesize and design</td>
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<tr>
<td>solutions for this problem.</td>
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<tr>
<td>7. Ability to evaluate the impact of these solutions in the broader</td>
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<tr>
<td>context of the organization and society.</td>
<td></td>
</tr>
<tr>
<td>8. Ability to effectively present and sell solutions in the form of</td>
<td></td>
</tr>
<tr>
<td>written, oral and electronic media.</td>
<td></td>
</tr>
<tr>
<td>9. Ability to accomplish life-long growth within the field/profession of</td>
<td></td>
</tr>
<tr>
<td>Human Factors and Ergonomics.</td>
<td></td>
</tr>
</tbody>
</table>

Thank your for your time and attention to this evaluation.
MS Human Factors Alumni Survey Form
Human Factors & Ergonomics
San Jose State University
Alumni Survey

Your Name:______________________________________________Year(s) Graduated: ____________
Email Address:__________________________________________Phone Number: ______________________________

Are you currently working as an HFE practitioner, or in a related field?  □YES  □NO.
And/or are you pursuing a PhD In HFE or a related field?  □YES

When you graduated, were you a US citizen or permanent resident?  □YES  □NO
If not, were you holding what type visa?  (Please check one.)

□ F-1 visa,
□ H-1B visa
□ H-4 visa

In addition, are you currently residing in the US?  □YES  □NO
How long after graduation, did you start a full-time job?  _______________________________
Will, or did, your employer sponsor your application for an H-1 work visa?  □YES  □NO

Which industry are you currently working in?
□ Research
□ Manufacturing
□ Service
□ Government
□ Software
□ Other ____________________________________________
Please list your current job title and employer and three previous job titles and employers starting with the **Most recent HFE position**, you held following graduation. Please indicate country if it is not the US.

i. (current position)_______________________________________________________
   
   ____________________________________________________Dates:_______
   
   j. (previous position)_______________________________________________________
   
   ____________________________________________________Dates:_______
   
   k. (previous position)_______________________________________________________
   
   ____________________________________________________Dates:_______
   
   l. (first position)_______________________________________________________
   
   ____________________________________________________Dates:_______

List your most significant professional achievements since you graduated:

In the last 3-5 years, to what extent did you use the following HFE program topics?

Please indicate your answer on the line BELOW each skill.
<table>
<thead>
<tr>
<th>Ergonomics Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
</tr>
<tr>
<td>1-2 times/quarter</td>
</tr>
<tr>
<td>1-2 times/month</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
</tr>
<tr>
<td>1-2 times/quarter</td>
</tr>
<tr>
<td>1-2 times/month</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interface Design and Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
</tr>
<tr>
<td>1-2 times/quarter</td>
</tr>
<tr>
<td>1-2 times/month</td>
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<table>
<thead>
<tr>
<th>Human System Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
</tr>
<tr>
<td>1-2 times/quarter</td>
</tr>
<tr>
<td>1-2 times/month</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modeling &amp; Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
</tr>
<tr>
<td>1-2 times/quarter</td>
</tr>
<tr>
<td>1-2 times/month</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
</tr>
<tr>
<td>1-2 times/quarter</td>
</tr>
<tr>
<td>1-2 times/month</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operations Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
</tr>
<tr>
<td>1-2 times/quarter</td>
</tr>
<tr>
<td>1-2 times/month</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Artifact/systems Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
</tr>
<tr>
<td>1-2 times/quarter</td>
</tr>
<tr>
<td>1-2 times/month</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Workplace Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
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<tr>
<td>1-2 times/yr.</td>
</tr>
<tr>
<td>Routinely</td>
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<tr>
<td>1-2 times/quarter</td>
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<tr>
<td>1-2 times/month</td>
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<td></td>
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<tr>
<td>-----------------------------------------------------------------</td>
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<tr>
<td><strong>Experimental Design</strong></td>
</tr>
<tr>
<td><strong>Statistical Analysis</strong></td>
</tr>
<tr>
<td><strong>Interpretation and Report Generation</strong></td>
</tr>
<tr>
<td><strong>Cognitive Task Analysis</strong></td>
</tr>
<tr>
<td><strong>Other Skills:</strong></td>
</tr>
</tbody>
</table>

What topics/skills, knowledge and abilities have you needed that we did not teach you?

What did we teach you that you wish had been covered more thoroughly?
Do you consider yourself to be an effective problem solver relative to the content of your HFE curriculum? In what ways could we have better prepared you?

What kinds of systems design challenge(s) and/or other problem(s) have you solved for your organization. Was your solution accepted? Was your solution implemented?

Did the HFE program prepare you very well for your first job and subsequent jobs? Why or Why not?
Have you taken any post graduation courses, training sessions, and/or workshops?

e. What topics?

f. Company sponsored?

Thank you for completing this survey, please feel free to include any thoughts or comments to help us improve the HFE program.
Table 7 – ISE Graduate Program – Outcome Mapping Matrix

<table>
<thead>
<tr>
<th>Program Outcome:</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i</th>
<th>j</th>
<th>k</th>
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<tbody>
<tr>
<td>Required Courses</td>
<td></td>
<td></td>
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<td>ISE 202</td>
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The Outcome Mapping Matrix above indicates that across the ISE curriculum, each outcome is addressed many times at all levels of Bloom’s Taxonomy. The table also points out the contributions of the Engineering Core and technical writing course to the achievement of Program Outcomes.

Table 7 – Human Factors/Ergonomics Program – Outcome Mapping Matrix

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+ Skill level 1 or 2 in Bloom’s Taxonomy ++ Skill level 3 or 4 in Bloom’s Taxonomy +++ Skill level 5 or 6 in Bloom’s Taxonomy ✓ Skills relevant but not presently assessed
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