

## IE 361 Syllabus

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**Required Text:** *Statistical Quality Assurance Methods for Engineers* by Vardeman and Jobe

**Other References:** *Probability and Statistics for Engineers* by Devore  
*Basic Engineering Data Collection and Analysis* by Vardeman and Jobe

### Catalogue Course Description

Statistical Quality Assurance. (Same as Stat 361.) (3-0) Cr. 3. F.S. Statistical methods for process improvement. Simple quality assurance principles and tools; modern quality culture including TQM, 6 Sigma, ISO 9000, and Baldrige. Measurement system precision and accuracy assessment. Control charts. Process capability assessment. Experimental design and analysis for process improvement. Significant external project in process improvement. Nonmajor graduate credit.

**Prerequisite:** Stat 231 or Stat 401 (This is a real prerequisite! If you have not had one of these or a genuinely equivalent course that you have taken seriously, you are not prepared for IE 361. Repair the deficiency and take this course at a later offering.)

### Course Objectives

- a. Students will learn the key concepts of engineering quality assessment.
- b. Students will learn quantitative and analytical techniques for problem-solving related to quality assurance and improvement.
- d. Students will gain experience in applying the concepts and methods through team projects.

### Topics Covered

Measurement and Statistics  
Basic Control Chart Methods  
Process Characterization and Capability Analysis  
Experimental Design and Analysis for Process Improvement

<b>Course Grading:</b>	Exam I	100 pts
	Exam II	100 pts
	Exam III (Final)	100 pts
	Labs	30 pts
	Course Project	270 pts

<b>Important Dates:</b>	Initial Project Proposal Due	T September 22
	Mid-Course Project Interviews	Week of September 28
	Exam I	T October 6
	Project Progress Report Due	T October 27
	Exam II	T November 10
	In-Class Presentations	T December 8
	Evening Poster Session	T December 8 (7:00 PM)
	Written Project Report Due	F December 11
	Final/Exam III	M December 14 (2:15 PM)
	Labs Due	Wednesday noon "the week after"

**NOTICE the "final" is required for EVERYONE in class.**

**Labs:** Tuesdays, 3:40-5:40, 204 Carver

**Lectures:** On the Web, Links on the Course Page:

<http://www.public.iastate.edu/~vardeman/IE361/ie361vard.html>

**"Vardeman Live for Free":** (R 9-11 1077 Black) Vardeman will do the Web lectures live for any interested students.

**.pdf Version of Revised Chapters 1-3 of Vardeman and Jobe:** Vardeman will tell you where you may find an updated electronic version of the first three chapters of the textbook.

### **Contribution of Course to Meeting the ABET Professional Component**

Students will learn the key basic concepts and methods of quality assurance, and how to apply these concepts and methods in identifying, formulating, and solving problems that are relevant to production and/or service systems. Students will learn the quantitative and analytical techniques typically used in the solving problems associated with quality assurance. Also, students will gain team project experience in quality improvement, in collaboration with area manufacturing and service companies. 3 credits of engineering topics.

### **Academic Honesty Statement**

The IMSE Department has an expectation that all students will be honest in their actions and communications. Individuals suspected of committing academic dishonesty will be directed to the Dean of Students Office as per University policy. For more information regarding Academic Misconduct see

<http://www.dso.iastate.edu/ja/academic/misconduct.html>

### **Professionalism Statement**

The IMSE Department has an expectation that all students will behave in a professional manner during all interactions with fellow students, faculty, and staff. Treating others with respect and having constructive communications are examples of being professional.

### **Accommodation for Students with Disabilities**

Iowa State University complies with the American with Disabilities Act and Sect 504 of the Rehabilitation Act. If you have a disability and anticipate needing accommodations in this course, please contact Vardeman before the end of the 2<sup>nd</sup> week of the semester. Later requests for accommodations may not be honored. Anyone requesting an accommodation will need to obtain a SAAR form with recommendations for accommodations from the Disability Resources Office, located in Room 1076 of the Student Services Building.

## Out-of-Class Group Project / IE 361 / Fall 2009

As part of the requirements for IE 361, you will carry out a process-oriented quality improvement project with a (real) client of your own choosing/recruiting. To the extent possible, you should attempt to carry through an iteration of the process-oriented quality assurance cycle laid out in Table 1.1 of the text.

### A. Purposes of the Project

The purpose of the project is to practice with the course material and to strengthen your skills of problem formulation and solution, cooperation with others, and professional oral and written communication.

### B. Group Size

Group size will be 3 or 4. Students will organize their own groups (more or less, anyway). **(As soon as a group has organized, please send Vardeman an e-mail naming the members and giving e-mail addresses.)**

### C. Project Milestones/Reports

1. An initial **project proposal** is due September 22. This one page report should name the team members and proposed client, and should outline the general area in which the team and client plan to cooperate. Provide contact information for your client (preferably including an e-mail address). e-mail these to Vardeman in .pdf format. Vardeman will meet with your group during the following week to help you formulate a sensible plan of action for your project.

2. A written intermediate **progress report** (not more than 2 typewritten pages) is due October 27. By this point your problem should be well formulated and an initial plan for solution be agreed upon among team members and client. This progress report should include a careful problem statement, an outline of the planned solution with a time table for completion and a statement initialed by the client indicating his/her agreement with your plans.

The lab period on October 27 will be spent in informal discussion of project progress. Each team will prepare 4-5 PowerPoint (or .pdf) slides for a 5-minute presentation by one team member describing the progress to date and plan for completion. These informal presentations will be followed by class discussion. Bring paper copies of the slides for Vardeman to mark on during the presentation and discussion. **DO NOT USE** jargon that people outside your group will fail to understand!

3. A three part, **professional quality** final report will summarize your work on this project. You will produce:
- a) A professional quality display, fitting on one piece of foam (illustration) board (**not** poster board) between 32x40 inches and 36x48 inches in size. (This is your chance to tell your story ... the larger size gives you more room to do so. Vardeman will provide details regarding the possible use of a large scale printer in the ME Department for printing these.) This display should tell the whole story of your project and be able to stand by itself on an easel or the lip of a chalk board. It must be easily understood from a distance of 6-8 feet (**WATCH THE SIZE OF YOUR FONTS!**) Make good use of your space on this display. (Consider information density! Space used should be in proportion to information conveyed. Prettiness for prettiness sake is a waste of precious space. Raw JMP reports are probably too dense for just pasting into the display, especially without explanation.) No more than 300 words may appear on this (and many effective displays have had far fewer than this number). We will hold an evening "reception"/poster session on Tuesday December 8, where class members, other IE students and faculty, the Engineering deans and project clients are invited to view these displays and talk with you about what you accomplished in your project. The IMSE Department faculty will judge posters at this session for semester "Best IE 361Poster" awards. This display should **not** look like something a middle-schooler put together with glue, dull scissors and construction paper!
  - b) An oral report will be presented in lab on December 8. Guidelines for this report are:
    - i) All team members must participate in the oral presentation.
    - ii) Report length (excluding Q&A) will be 12+/-1 minutes. (Practice and time yourselves! Deviations from this guideline will not be well received.)

- iii) PowerPoint or .pdf files will be used. Bring the presentation on a USB "thumb drive." You should begin with a title slide, and produce other (professional quality) slides outlining your main points, giving drawings/schematics of parts or machines you worked on, showing graphical summaries of data you collected and used, etc. Be sure beforehand that these are big and clear enough to be seen by everyone in the classroom. (Watch the contrast and don't use a "busy" background. **Read and PAY ATTENTION to the PowerPoint Pointers on the course web page.**) **Make and bring with you transparency versions of your slides as a "failsafe" measure, so that if technology fails you, the presentation can go on using an overhead projector.** Bring a paper copy of the set of slides for Vardeman to mark up (and comment on your presentation) while you are presenting.
- iv) The report should provide adequate background for a listener with no prior knowledge of your client's business or your project, and then go on to emphasize methodology, obstacles overcome and the results/process improvements obtained.
- v) Some time (about 2 minutes) will be allowed for questions and comments from the audience.
- c) A single written report from each team is due at Vardeman's office by 5PM on F December 11. ALSO e-mail Vardeman a copy of this report IN .PDF FORMAT. The hard copy will not be returned. This paper report must be bound in some form, so that pages cannot inadvertently get lost. (A cheap loose leaf binder is acceptable. **DO NOT USE** a plastic folder that only employs pressure to hold pages in place. Pages always come loose from those!) All pages and all figures should be numbered and all figures should have descriptive captions. All figures should be referred to by number in the text and any items listed in a bibliography or reference section should be explicitly referred to in the text. Some general pointers on the writing of technical reports (not all of which are relevant to this report) can be found in the document "Writing Short Technical Reports" by Wallace Hopp posted on the course web page. A set of Vardeman "student writing pet peeves" is also on the Web page. Read both of those and pay attention to especially the latter! The audience for this report is dual (you must write so that both can understand the report): your client AND your engineering manager (Vardeman) who expects you to use the best statistical technology available if any is employed. (This means that IF the client has company statistical software he or she wants you to use and it does anything different from what was presented in class, you need to show both sets of calculations.) The report is to include at least:
  - i) A title page giving the project title and date, team member names, phone numbers and e-mail addresses, and complete contact information for your client (mailing address, phone number and e-mail address).
  - ii) A one page executive summary describing the project and main results for your busy audience.
  - iii) A table of contents for the whole report including appendices. (Include page numbers!)
  - iv) An introduction giving background to the problem, sketches or photos of equipment involved and a quantitative assessment of the quality situation at the beginning of team involvement. (Be sensitive to matters of corporate security here. Don't photograph anything unless you have explicit permission to do so.)
  - v) A description of the work done by the team in search of a problem solution/quality improvement. Although details of calculations, data collection sheets, etc. should be deferred to appendices, this section should "tell the whole story" of the team's efforts using whatever prose, graphs, tables, sketches, etc. are needed.
  - vi) A recommendations/results/project impact section. Ideally, team efforts will lead to recommendations for the client that can be implemented and their impact evaluated and reported in the final write-up. At a minimum, realistic (practically implementable) recommendations and justification for them should be included in the report.
  - vii) Appendices. Include as appendices carefully documented lists of data collected by the team (include date, technician, unit of measure, etc.), listings of computer programs written for the project, **fully annotated** computer outputs, detailed "hand" calculations, and copies of the project proposal and progress report. (The relevance of any such appendix material should be immediately clear to the reader. Do not leave a reader guessing why the appendix material was included. Appendix material included should be referred to in the body of the report. Be sure any appendices are clearly labeled!)
  - viii) The paper copies of your slides given to Vardeman at the oral presentation.

- ix) Sealed envelopes (one from each team member) containing an assessment of percentage of total team effort provided by every team member. (If it becomes clear that the project workload was unbalanced, your instructor may assign different project grades to different team members.)
- x) The peer comment sheets from your oral report. (See D. below.)
- xi) A receipt from your client indicating that he/she has received a copy of your final written report AND an evaluation by the client of the quality and value of your work to his or her organization in the form of filled out ABET Evaluation Tables, one for each team member. (The blank table will be posted on the course web page so that you and your client can get to it.) This "receipt" and "ABET tables" may be returned to Vardeman by e-mail if the client prefers. (In your early discussions with prospective clients, you need to make them aware that your instructor will need this feedback from them.)

Use i) through xi) above as a checklist, and **do not fail to include any of these items** (except possibly vii) if appendices are not needed).

#### **D. Instructor and Peer Feedback**

Vardeman will react in writing to your project proposal and progress report and meet with your group during late September/early October to discuss your approach to your client's situation. Provided you submit them December 4 (and in proposed final form), Vardeman will also provide "free" (ungraded) feedback on your visuals for the in-class presentation (in time for you to correct/improve them before making the presentation). Further, provided you submit (again in proposed final form ... Vardeman will NOT try reviewing a half-baked disorganized document) it by December 4, Vardeman will ("for free," i.e. without any grading consequences) mark up a draft of your written report in time for you to make improvements before turning in the final report on December 11. (In fact, he will do multiple iterations of this on a first-come-first-served basis ... as time and his workload permit. Send all of these documents to Vardeman via e-mail in .pdf format.) He will also mark up your final report and prepare a summary sheet of his overall assessment of your work that you may see after course grades are completed.

Your peers will write comments on your oral report that will be given to you at the end of class on your report day. (These and your instructor's comment sheet on your oral report are to be returned with your final written report!)

#### **E. Acceptable Topics and Grading Criteria**

An ideal project will focus on a client process producing a good or service, complete a logical analysis of how that process works, formulate appropriate measures of process performance, collect process data, assess and make any changes needed to establish process stability, characterize "stable process performance" and work to the improvement of the process that has been brought into stability. The ideal project has a client who owns the problem/process and works closely with the team, allowing it substantial "hands on" (or near hands on) contact with the process, and stands to gain real benefit from successful project completion. The client could be a manufacturing engineer, a shop manager, a Q.C. analyst, a small business owner, etc. Ideally, techniques used in the project will be drawn from those discussed in IE 361.

It is unlikely that every project team will find an "ideal" project. Project grades will be assigned partially on the basis of topic quality (potential and interest), partially on the basis of the technical merit of the team effort and the real usefulness of the project to the client, and partially on the quality and professionalism of the reports produced by the team (including the proposal, progress report and display). The final report should leave no doubt in the reader's mind that the work done was truly design and not merely "real world" or "data analysis" work.

The project will be graded according to:

- Topic Quality/ Real Potential for a Contribution and Originality 20%
- Technical Merit of the Work and Real Usefulness to Client 25%
- Display (Clarity, Completeness, Professional Polish, and General Effectiveness) 15%
- Oral Report (Clarity, Completeness, Professional Polish, and General Effectiveness) 15%
- Written Report (Clarity, Completeness, Professional Polish, and General Effectiveness) 25%

**Pay attention to this set of guidelines! Your work will be judged against it!**