

**SIE 606 ADVANCED QUALITY ENGINEERING - Spring 2009**  
**( Tuesday 3:30 – 6:00 PM)**

**Instructor:** Jian Liu  
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**TA:**  
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**Prerequisites:** SIE 530 : Engineering Statistics  
SIE 506 :

**Textbook:** R.A. Johnson and D.W. Wichern, *Applied Multivariate Statistical Analysis*, 5<sup>th</sup> ed., Pearson Prentice Hall, Upper Saddle River, NJ, 2007.

**Course Website:** We will be using the D2L system. (<http://d2l.arizona.edu/>). All class materials, including HW, handouts, etc. will be distributed from D2L. After each lecture, I will be posting the link of the lecture video on the streamed sever for distance-learning students. I will also be sending emails to the whole class throughout the semester using the class list in D2L. Please make sure you forward your D2L email to an email account that you frequently use.

**References:**

- D.C. Montgomery, *Introduction to Statistical Quality Control*, 5<sup>th</sup> ed., Wiley, New York, 2004
- R.J. Muirhead, *Aspects of Multivariate Statistical Theory*, Springer, Wiley, New York, c1982.

**Course Objectives:** This course covers topics in quality control that have been widely used in many industries. Specifically, it focuses on advanced multivariate statistical analysis techniques that exhibit potentials in *quality control* applications. Most multivariate statistics topics are followed by the corresponding quality control practices. The goal is for students to understand the concepts, operation, and role of the introduced analytic techniques.

**Homework:** The homework will be assigned on Thursdays and due on the following Thursday, *before the end of the class*. NO late submission is allowed unless it is requested and approved by the instructor in advance (e-mail or phone-call received *before* the day the assignment is due). Distance-learning students may submit pdf copies of their homeworks to a dropbox on D2L.

**Examinations:**

Exam I: in class  
Exam II: Take home

Makeup examinations MUST be requested at least one week prior to the date the exam is held. In case of medical or other personal/family emergencies, a formal excuse (doctor's note, etc.) is required.

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| <b>Grading:</b> | Homework | 20% |
|                 | Exam I   | 25% |
|                 | Exam II  | 25% |
|                 | Project  | 30% |

**Academic Integrity Policy:** Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, homework, and exams must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity: <http://dos.web.arizona.edu/uapolicies/>. Any violation of the academic integrity code will be dealt with using the procedures detailed in the code.

**Course Outline:**

- Review of Conventional Statistical Process Control (SPC)
  - Basic statistics
  - Basic principles and techniques for SPC
  - Charts for variables
  - Charts for attributes
  - Capability Analysis
- Random Vectors and Random Sampling
  - Descriptive statistics
  - Linear combinations of random variables
  - The multivariate normal distribution
  - Other multivariate distribution
- Multivariate Statistical Inference
  - Maximum Likelihood Estimation
  - Inference about a mean vector
  - Inference about a covariance matrix
- Multiple Linear Regression Models
  - Linear regression model
  - Estimation methods
  - Inferences about the regression model
- Multivariate SPC for Process Monitoring
  - Monitoring multivariate process mean
  - Chi-square control chart
  - T-square control chart
  - Interpretation of out-of-control signals
- Multivariate Statistical Data Analysis for Process Diagnosis
  - Principal Component Analysis
  - Factor Analysis