IRA A. FULTON SCHOOLS OF engineering
ARIZONA STATE UNIVERSITY

The Polytechnic School
Engineering Program

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The Polytechnic School
EGR522 Statistics for Quality Control in Manufacturing

Catalog Description: QC tools, Control Charts and Cusum Control Charts for data analysis and interpretation; Auto-correlation, Decision theory, Process capability, Lean Manufacturing and Quality system.

In-person version:
This course is offered only as an in-person mode.

Prerequisite: Graduate student.

Prerequisite background: This is a graduate level course intended for MS in manufacturing students. These graduate students will have a mathematical maturity and are expected to learn the necessary statistical background material quickly. There will be more focus on case study and group work.

Course Objectives: This main objective of this course is to give a theoretical and practical overview of Statistical methods for products improvement. Gain skills needed to apply statistical thinking to quality improvement using facts, data, and analysis. Develop and analyze process-appropriate charts. The students will conduct case studies and also conduct experiments in the lab to understand Sigma R&R and learn in a cooperative setting.

Course Description: Students will be exposed to method of monitoring, controlling and, ideally, improving a process through statistical analysis. The four basic steps include measuring the process, eliminating variances in the process to make it consistent, monitoring the process, and improving the process to its best target value. Real world process improvement would be brought into the class room lectures to introduce statistical process control techniques in the manufacturing.

Course Contents

1. **Statistics (1 session of 3 hrs each)**
    - Univariate data (central tendency, Spread)
    - Multivariate data (Pearson's correlation)
    - ANOVA (Between subjects, Factorial Between-subjects and within-subjects/Repeated Measure) and
2. **Process Control (1 session of 3 hrs each)**
    - Notion of quality, history, importance, definitions, principles, impact on competitive advantage and financial return

- Total Quality Management and Statistical Process Control
- Repeatability and Reproducibility indices

3. **Seven QC tools using SPSS software program (2 sessions of 3 hrs each)**
   - QC tools
   - Data collection and analysis/Students' Projects
4. **Control Charts using SPSS software program (2 sessions of 3 hrs)**
   - Introduction to control charts
   - Control Charts for Variables data
   - Control Charts for Attributes data
   - Interpretation of control charts – special and common causes
5. **Cumulative sum (Cusum) charts (2 sessions of 3 hrs)**
   - Introduction to time-weighted charts (Cusum charts)
   - Interpretation of Cusum charts
   - Cusum decision procedures
6. **Process Capability (2 sessions of 3 hrs)**
   - Concept of process capability
   - Process capability indices
   - Six sigma methodology
7. **Auto-correlation (1 session of 3 hrs)**
   - Introduction to Autocorrelation
   - Autocorrelation Coefficient
   - Autocorrelation plots
   - Testing and Remedial Measures for Autocorrelation
8. **Statistical Decision Theory (1 session of 3 hrs)**
   - Statistical Model and Decision Making
   - Hypothesis Testing
   - Estimation - Mean-Squared Error (MSE) and Cramér-Rao Lower Bound, and Maximum Likelihood Estimator, Consistency, and Efficiency
9. **Lean Manufacturing and Quality Systems (1 sessions of 3 hrs)**
   - Lean Manufacturing and Quality Systems
   - Implementation and maintenance of ISO 9000
10. **Presentation/Group Discussion/Lab Experiment (1 session of 3 hrs)**
    - Quality Awards
    - Quality tools: Implementation and effectiveness
    - Lab experiment on R & R

Course Materials

Required:

1. Classroom PowerPoint presentations and handouts
2. JURAN'S QUALITY HANDBOOK, Joseph M. Juran, A. Blanton Godfrey, Robert E. Hoogstoel and Edward G. Schilling, Fifth Edition, McGraw-Hill, 1999
3. Quality Toolbox, Nancy R. Tague, Second Edition, ASQ Quality Press, 2005

4. Davim, J. Paulo (Ed.), Statistical and Computational Techniques in Manufacturing, Springer-Verlag Berlin Heidelberg, 2012.

Optional:

1. J. Oakland, Statistical Process Control, Sixth Edition, 2008
2. Basic Statistical Ideas for Managers, D. Hildebrand, R.L. Ott and J.B. Gray, Second Edition, Thomson, 2005
3. NIST International Sematech e-Handbook, 2005
4. Tim Stapenhurst, Mastering Statistical Process Control - A Handbook for Performance Improvement Using Cases, Elsevier, 2008
5. Thomas P. Ryan, Statistical Methods for Quality Improvement (Wiley Series in Probability and Statistics) 2nd Edition, 2000.

Attendance:

Attendance is required for all of the face-to-face classroom sessions

If you anticipate not being able to attend any face-to-face classes due to travel restrictions or personal health concerns, you are expected to contact me at amk@asu.edu at the beginning of the semester or as soon as your situation changes to notify them of this fact.

Grading:

This course is graded using a regular letter scale from A+ through E. The grading scale is:

100 – 96 %	A+
95.9 – 92.6 %	A
96.5 – 89.5 %	A-
89.4 - 86 %	B+
85.9 – 82.6 %	B
82.5 – 79.5 %	B-
79.4 – 76 %	C+
75.9 – 69.5 %	C-
69.4 – 59.5 %	D
< 59.4 %	E

Classroom Behavior

Cell phones and pagers must be turned off during class to avoid causing distractions. The use of recording devices is not permitted during class. Any violent or threatening conduct by an ASU student in this class will be reported to the ASU Police Department and the Office of the Dean of Students.

Academic Integrity

All students in this class are subject to ASU's Academic Integrity Policy (available at http://provost.asu.edu/academicintegrity) and should acquaint themselves with its content and requirements, including a strict prohibition against plagiarism. All violations will be reported to the Dean's office, who maintain records of all offenses. Students are expected to abide by the FSE Honor Code (http://engineering.asu.edu/integrity/).

Title IX is a federal law:

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling is available if you wish to discuss any concerns confidentially and privately. ASU online students may access 360 Life Services, https://goto.asuonline.asu.edu/success/online-resources.html.

General Information: (First four items are required, others as you wish)

1. Students are expected to participate in the educational process and not be a disruptive element with regard to the learning of others. Safety, self discipline and respect for others are necessary elements in the educational processes employed in this course.
2. All students should be familiar with the Student Code of Conduct, which can be found at http://www.asu.edu/studentlife/judicial/. Detailed information on the Student Code of Conduct may be found at http://www.asu.edu/aad/manuals/usi/usi104-01.html.
3. Students are expected to execute all course assignments and activities in accordance with the University's Student Academic Integrity Policy in the 2007-2008 general catalog located at http://www.asu.edu/aad/catalogs/general/ug-enrollment.html#27839 under the heading *Retention and Academic Standards*.
4. The Americans with Disabilities Act (ADA) is a Federal antidiscrimination statute that provides comprehensive civil rights protection for persons with disabilities. If you believe you have a disability requiring an accommodation please contact the Disability Resource Center at ASU Polytechnic located in Student Affairs Quad # 4 or call 480-727-1039 / TTY: 480-727-1009. Eligibility and documentation policies are online at http://www.asu.edu/studentaffairs/ed/drc/
5. I expect you to come to class prepared. This includes completing any reading, assignments, or exercises that are assigned. I encourage you to keep up with class activities and be consistent throughout the semester. If you have any concerns, anxieties, or requests, please let me know as soon as possible.
6. Take responsibility for learning the concepts and applications presented during the course. Come and see me promptly if you need help. Do not wait until the last few weeks of the semester to get help.
7. If you have any concerns, anxieties, or requests, please let me know as soon as possible, we are all here to learn and have a good time.

Instructor Information

Professor Arunachala Kannan, PhD
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Arizona State University at the Polytechnic campus

Office Hours: Mondays 10:30 to 11:30 AM (Peralta 335A)