

STATISTICS 5474
STATISTICAL THEORY OF QUALITY CONTROL
FALL SEMESTER, 2009

JUSTIFICATION:

Statistical techniques are widely used in industry and many other areas to improve quality and productivity. This course is designed to give graduate students in statistics, engineering, management science, and other areas an understanding of the statistical methods and theory that form the basis for the procedures that are used in applications. This course covers various statistical process control and acceptance sampling techniques, and brings in background material from statistical inference, sequential analysis, stochastic processes, and decision theory that is needed for the development of these techniques.

CLASS: 9:05 – 9:55 MWF, 310 Hutcheson Hall

INSTRUCTOR: Marion R. Reynolds, Jr., 411 Hutcheson Hall, 231-7931, mrr@vt.edu

OFFICE HOURS: I will usually be available from about 11:10 - 11:40 MWF (after my second class). I am willing to see students at other times when I am in the office, but it is worth checking in advance to make sure that I am available.

GRADING: The grade for the course will be determined approximately as follows:

Midterm Exam	35%
Homework	25%
Final Exam	40%

HOMEWORK: Homework will be assigned approximately once per week, and most assignments will be collected for grading.

SYLLABUS:

- I. Acceptance Sampling, Sequential Methods, Stochastic Processes, and Decision Theory
 - (a) Introduction
 - (b) Single Sample Inspection
 - (c) Sequential Inspection
 - (d) The Sequential Probability Ratio Test
 - (e) Rectifying Inspection and Sampling Schemes
 - (f) Some Stochastic Processes Methods for Quality Control Applications

- (g) Decision Theory Approaches to Acceptance Sampling
- (h) Acceptance Sampling by Variables

II. Process Monitoring

- (a) Introduction
- (b) Shewhart-Type Control Charts
- (c) Testing for Control
- (d) Additional Signal Rules for Shewhart Control Charts
- (e) CUSUM Control Charts for the Mean
- (f) CUSUM Control Charts for Other Parameters
- (g) EWMA Control Charts
- (h) Simultaneous Monitoring of the Mean and Variance
- (i) Sampling from the Process
- (j) Decision Theory Approaches
- (k) Robust Control Charts
- (l) GLR Control Charts
- (m) Multivariate Control Charts

TEXTS AND SPECIAL TEACHING AIDS:

The course will be based primarily on lecture notes. Readings may occasionally be assigned from various reference books and journal articles.

REFERENCE BOOKS:

Basseville, Michèle and Igor V. Nikiforov (1993). *Detection of Abrupt Changes*. Prentice Hall, Englewood Cliffs, New Jersey.

Box, George and Alberto Luceno (1997). *Statistical Control by Monitoring and Feedback Adjustment*. Wiley, New York.

Del Castillo, E. (2002). *Statistical Process Adjustment for Quality Control*. Wiley, New York.

Dobben de Bryun, C.S. Van (1968). *Cumulative Sum Tests: Theory and Practice*. Griffin, London.

Dodge, Harold F. and Harry G. Roming (1959). *Sampling Inspection Tables: Single and Double Sampling*, 2nd Edition. John Wiley, New York.

- Duncan, Acheson J. (1986). *Quality Control and Industrial Statistics*, 5th Edition. Irwin, Homewood, Illinois.
- Ghosh, B.K. (1970). *Sequential Tests of Statistical Hypotheses*. Addison-Wesley, Reading, Massachusetts.
- Grant, Eugene L. and Richard S. Leavenworth (1988). *Statistical Quality Control*, 6th Edition. McGraw-Hill, New York.
- Guenther, William C. (1977). *Sampling Inspection in Statistical Quality Control*. Hafner, New York.
- Hawkins, Douglas M. and David H. Olwell (1998). *Cumulative Sum Charts and Charting for Quality Improvement*. Springer, New York.
- Montgomery, Douglas C. (2005). *Introduction to Statistical Quality Control*, 5th Edition. John Wiley, New York.
- Mukhopadhyay, Nitis, Sujay Datta, and Saibal Chattopadhyay. *Applied Sequential Methodologies*. CRC Press, Boca Raton, Florida.
- Quesenberry, Charles P. (1997). *SPC Methods for Quality Improvement*. John Wiley, New York.
- Ryan, Thomas P. (2000). *Statistical Methods for Quality Improvement*, 2nd Edition. John Wiley, New York.
- Shilling, Edward G. (1982). *Acceptance Sampling in Quality Control*. Marcel Dekker.
- Wadsworth, Harrison M., Jr., Kenneth S. Stephens, and A. Blanton Godfrey (2002). *Modern Methods for Quality Improvement*, 2nd Edition. John Wiley, New York.
- Wetherill, G. Barrie and Don. W. Brown (1991). *Statistical Process Control*. Chapman and Hall, London.