INSTRUCTOR:  Dr. Tomas Velasco, C.S.S.B.B., C.Q.E.
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TEXTBOOK:


REFERENCES:

**TEXTBOOKS**


• **Rath & Strong’s Six Sigma Pocket Guide**, Rath & Strong, Inc; Spiral edition.


**Audiovisuals**
- Against all Odds: Inside Statistics Series, 1988
Objective:
The purpose of this course is to provide the student with a comprehensive coverage of the knowledge areas and tools of Six Sigma beyond green-belt training, focusing on descriptive and analytical methods to deal with variability including point and interval estimation, hypothesis testing, Analysis of Variance (ANOVA), One-factor designs, Blocked designs, Latin-Square designs, and Graeco-Latin Square Designs.

Requirements:
Major emphasis will be placed on reading and understanding the material from the class, suggested books and reference material prior to class, and in homework assigned. Class attendance is required.

Grading:
• 3 Examinations, each of which counts 20% towards your grade.
• Homework, Work in Groups, and Quizzes, which count 20% towards your grade.
• Final Project, which counts 20% towards your grade.

Standards:
Letter grades are assigned based on the total number of points accumulated.
• A : 90% and higher
• B : 80% - 89.99%
• C : 70% - 79.99%
• D : 60% - 69.99%
• F : Less than 60%

Office Hours:
11:00 am to 12:00 m on Mondays, 9:30 am to 11:30 m. on Tuesdays and Thursdays, 2:30 pm to 3:30 pm. on Wednesdays; other hours by appointment.

Equipment and Software:
Hand-held calculator and any computer-based spreadsheet. Excel is available in all the P.C. laboratories in Engineering.
Late Work Policy:
Missed examinations and assignments have a 10% penalty per day, imposed when turned in, unless an appropriate, prior excuse is provided to the instructor. The missed examination must be completed on the make-up date set by the instructor.

Academic Conduct / Student Code of Conduct:
Cheating on examinations, submitting work of other students as your own, or plagiarism in any form will result in penalties ranging from an F on the assignment to expulsion from the university, depending on the seriousness of the offense. Please refer to the following sites for information on the SIU’s student code of conduct and Morris Library’s guide on plagiarism:

Emergency Procedures:
Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the S.I.U.C. Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on the BERT’s website at [www.bert.siu.edu](http://www.bert.siu.edu), Department of Public Safety’s website [www.dps.siu.edu](http://www.dps.siu.edu) (disaster drop down) and in the Emergency Response Guidelines pamphlet. Know how to respond to each type of emergency. Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency. The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.

SIU Policy on Incomplete Grades
An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within a time period designated by the instructor but not to exceed one semester from the close of the term in which the course was taken, or graduation, whichever occurs first. Should the student fail to complete the course within the time period designated, not to exceed one semester, or graduation, whichever occurs first, the incomplete will be converted to a grade of F and the grade will be computed in the student’s grade point average. Students should not reregister for courses in which an INC has been assigned with the intent of changing the INC grade. Re-registration will not prevent the INC from being changed to an F.

Mobile Technology Policy
Students may use laptops, tablets, netbooks, e-readers during class time but smart-phones should be off during the duration of the class. No electronic device should be used during a test, except a calculator.
**Inclusive Excellence**
SIU contains people from all walks of life, from many different cultures and sub-cultures, and representing all strata of society, nationalities, ethnicities, lifestyles, and affiliations. Learning from and working with people who differ from you is an important part of your education in this class, as well as an essential preparation for any career.

**Resources for Academic Assistance**
Learning Support Services: [http://tutoring.siu.edu/](http://tutoring.siu.edu/)
- Provides academic assistance in courses/tutoring

Disability Support Services: [http://disabilityservices.siu.edu/](http://disabilityservices.siu.edu/)
- Provides the required academic and programmatic support services to students with permanent and temporary disabilities

SIUC Writing Center: [http://write.siu.edu/](http://write.siu.edu/)
- Offers free tutoring services to all SIUC undergraduate and graduate students and faculty.

**SIU Email Policy**
Official SIU Student Email Policy: [http://policies.siu.edu/policies.email.htm](http://policies.siu.edu/policies.email.htm)

**Saluki Cares**
The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in distress. By working closely with faculty, staff, students and their families, SIU Carbondale continues to display a culture of care by demonstrating to our students and their families that they are an important part of the community. To make a referral to Saluki Cares click, call, or send: [http://salukicares.siu.edu/index.html](http://salukicares.siu.edu/index.html), (618) 453-5714, or siucares@siu.edu.
MAJOR TOPICS:

- Sampling Distributions and Point Estimation of Parameters – Chapter VII
- Statistical Intervals for a Single Sample – Chapter VIII
- Test of Hypotheses for a Single Sample – Chapter IX
- Statistical Inference for Two Samples – Chapter X
- Simple Linear Regression and Correlation – Chapter XI
- Multiple Linear Regression – Chapter XII
- Design and Analysis of Single-Factor Experiments – Chapter XIII (13-1 to 13-3)
- Randomized Complete Block Design of Experiments – Chapter XIII (13-4)
- Latin-Square Designs *(This topic won’t have chapter assigned in the textbook, but can be produced using Design & Analysis of Experiments by Douglas Montgomery)*
- Graeco-Latin Square Designs *(This topic won’t have chapter assigned in the textbook, but can be produced using Design & Analysis of Experiments by Douglas Montgomery)*

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Student Learning Objectives:

At the end of the course, the student should be able to:

- Explain the general concepts of estimating the parameters of a population or a probability distribution
- Explain the important role of the normal distribution as a sampling distribution
- Understand the central limit theorem
- Explain important properties of point estimators, including bias, variance, and mean square error
- Know how to construct point estimators using the method of moments and the method of maximum likelihood
- Know how to compute and explain the precision with which a parameter is estimated
- Know how to construct a point estimator using the Bayesian approach
• Construct confidence intervals on the mean of a normal distribution, using either the normal distribution or the t distribution method
• Construct confidence intervals on the variance and standard deviation of a normal distribution
• Construct confidence intervals on a population proportion
• Use a general method for constructing an approximate confidence interval on a parameter
• Construct prediction intervals for a future observation

• Construct a tolerance interval for a normal population
• Explain the three types of interval estimates: confidence intervals, prediction intervals, and tolerance intervals
• Structure engineering decision-making problems as hypothesis tests
• Test hypotheses on the mean of a normal distribution using either a Z-test or a t-test procedure
• Test hypotheses on the variance or standard deviation of a normal distribution
• Test hypotheses on a population proportion
• Use the P-value approach for making decisions in hypothesis tests
• Compute power and type II error probability, and make sample size selection decisions for tests on means, variances, and proportions
• Explain and use the relation between confidence intervals and hypothesis tests
• Use the chi-square goodness of fit test to check distributional assumptions
• Use contingency table tests
• Structure comparative experiments involving two samples as hypothesis tests
• Test hypotheses and construct confidence intervals on the difference in means of two normal distributions
• Test hypotheses and construct confidence intervals on the ratio of the variances or standard deviations of two normal distributions
• Test hypotheses and construct confidence intervals on the difference in two population proportions
• Use the P-value approach for making decisions in hypothesis tests
• Compute power, type II error probability, and make sample size decisions for two-sample tests on means, variances, and proportions
• Explain and use the relationship between confidence intervals and hypothesis tests
• Use simple linear regression for building empirical models to engineering and scientific data
• Understand how the method of least squares is used to estimate the parameters in a linear regression model
• Analyze residuals to determine if the regression model is an adequate fit to the data or to see if any underlying assumptions are violated
• Test statistical hypotheses and construct confidence intervals on regression model parameters
• Use the regression model to make a prediction of a future observation and construct an appropriate prediction interval on the future observation
• Apply the correlation model
- Use simple transformations to achieve a linear regression model
- Use multiple regression techniques to build empirical models to engineering and scientific data
- Understand how the method of least squares extends to fitting multiple regression models
- Assess regression model adequacy
- Test hypotheses and construct confidence intervals on the regression coefficients
- Use the regression model to estimate the mean response and to make predictions and to construct confidence intervals and prediction intervals
- Build regression models with polynomial terms
- Use indicator variables to model categorical regressors
- Use stepwise regression and other model building techniques to select the appropriate set of variables for a regression model
- Understand general strategies for experimentation
- Identify typical applications of experimental design
- Understand the basic principles of experimental design
- Understand the guidelines for designing experiments
- Identify most important historical milestones of statistical design
- Understand sampling and sampling distributions
- Understand and calculate inferences about differences in means for randomized design
- Understand and calculate inferences about differences in means for paired comparison designs
- Understand experiments with a single factor
- Determine hypotheses for single factor experiments
- Understand and calculate ANOVA tables
- Define, determine applicability, and interpret ANOVA’s results.
- Understand and calculate fixed effects model for a single factor experiment
- Understand assumptions for the single factor model
- Determine residuals for single factor experiment design
- Construct plots for model adequacy checking
- Interpret results from each of the model adequacy plots
- Understand concepts for methodologies used in comparing treatment means
- Compare treatment means using graphical methods
- Compare treatment means using Scheffe’s and Tukey’s methods
- Understand and use operating characteristic curves
- Determine sample size for a specific Type II error using operating characteristic curves
- Understand the economic analysis of a designed experiment
- Understand and calculate non-parametric methods for the analysis of variance
- Determine hypotheses for single factor randomized blocked designs
- Understand and calculate ANOVA tables for blocked designs
- Define, determine applicability, and interpret ANOVA’s results for blocked designs.
- Understand and calculate fixed effects model for a blocked single factor experiment
- Understand assumptions for the blocked single factor model
- Determine residuals for blocked single factor experiment design
- Construct plots for model adequacy checking of blocked designs
- Interpret results from each of the model adequacy plots for blocked designs
- Compare treatment means of blocked designs using graphical methods
- Compare treatment means of blocked designs using Scheffe’s and Tukey’s methods
- Determine sample size for a specific Type II error of a randomized blocked design using operating characteristic curves
- Determine hypotheses for single factor latin-square designs
- Understand and calculate ANOVA tables for latin-square designs
- Define, determine applicability, and interpret ANOVA’s results for latin-square designs.
- Understand and calculate fixed effects model for a latin-square experiment
- Understand assumptions for the latin-square model
- Determine residuals for latin-square designs
- Construct plots for model adequacy checking of latin square designs
- Interpret results from each of the model adequacy plots for latin-square designs
• Compare treatment means of latin-square designs using graphical methods
• Compare treatment means of latin-square designs using Scheffe’s and Tukey’s methods
• Determine sample size for a specific Type II error of a latin-square design using operating characteristic curves
• Determine hypotheses for graeco latin-square designs
• Understand and calculate ANOVA tables for graeco latin-square designs
• Define, determine applicability, and interpret ANOVA’s results for graeco latin-square designs.
• Understand and calculate fixed effects model for a graeco latin-square experiment
• Understand assumptions for the graeco latin-square model
• Determine residuals for graeco latin-square designs
• Construct plots for model adequacy checking of graeco latin square designs
• Interpret results from each of the model adequacy plots for graeco latin-square designs
• Compare treatment means of graeco latin-square designs using graphical methods
• Compare treatment means of graeco latin-square designs using Scheffe’s and Tukey’s methods
• Determine sample size for a specific Type II error of a graeco latin-square design using operating characteristic curves
• Understand and calculate balanced incomplete block designs