

# ST 361

# Introduction to

# Statistics for Engineers

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## *General Description*

### **Introduction**

Statistics provides methodology for designing the process of getting data, summarizing and interpreting the collected information, and drawing conclusions or generalities from experimental results or survey data. Statistical methods are often used in daily life to solve real-world problems. This course will help you develop an understanding of basic statistical concepts, examine a range of the most commonly applied statistical methods, and gain an understanding of when and how these methods may be applied.

In the past few years, the United States has found itself in an increasingly competitive world market. At present, various “total quality management” ideas and quality, productivity improvement techniques are used to improve operations of many American organizations. Many industries have adopted W. Edwards Deming’s philosophy that a product is never good enough and should be improved continually through the use of statistical methods. Recent quality-improvement programs emphasize the methodology of experimental design to build good quality into the product at design and manufacturing stages. Wasteful efforts such as inspecting finished products for bad quality are then minimized. Thus, we have developed this course to introduce the needed statistical tools for improving product quality.

### **Textbook**

The textbook for the course is *Applied Statistics for Engineers and Physical Scientists*, 2nd edition, by R.V. Hogg and J. Ledolter (1992). This textbook is written to respond to the needs of the American industries in their continuous-quality-improvement (CQI) programs. The text and this course manual

address most of the important subjects identified in the 1984 Conference of Statistical Education of Engineers such as omnipresence of variability, high value of graphical analysis, and the importance and essentials of statistically designed experiments.

The text can be purchased from Friday Center Books & Gifts at the Friday Center using the book order form in this manual, or online at <https://s4.its.unc.edu/HigherGrounds>.

### **Course Organization**

This course will cover most of the material in the text. The material is organized into five units.

Unit 1: Collection and Analysis of Information

Introduction, Chapter 1, Sections 5.1-1 and 5.4.

Unit 2: Random Variables and Their Probability Models

Chapters 2 and 3 (omitting Sections 2.4-3, 2.4-4, 3.3, and 3.4)

Unit 3: Applications of Sampling Theory and Statistical Inference Procedures

Chapters 4 and 6 (omitting Sections 4.6 and 6.1-2)

Unit 4: Design and Analysis of Experiments

Chapters 7 and 8, and Section 9.6

Unit 5: Model Fitting and Diagnosis

Chapter 9 (omitting Section 9.5-1)

Most courses in introductory statistics do not have time to cover the subjects in Units 4 and 5. But because these two units are extremely important to engineers (especially in CQI programs), design of experiments and multiple regression are emphasized in this course. As a result, the chapter on probability models (Unit 2) has been cut heavily. Throughout the lesson notes, summary tables of important formulas and examples are included to help you understand the statistical methods addressed in the text.

### **Written Assignments and Final Exam**

Statistics is a very problem-oriented subject, and the best way to learn the material is by working a variety of problems. After studying the material in each lesson, do the assigned practice problems in pencil and submit your answers to your instructor

for grading. Be sure to show all your work. Besides the assigned problems, there are many exercises in the text that you can do for practice. Answers to selected exercises are provided at the end of the textbook.

Because different texts have different notations, we recommend that you do not use supplementary texts other than as a source of additional problems. A hand-held calculator will be useful in completing the assignments and is required for the final examination. You may use the text and returned lesson assignments when you take the final examination. Your grades on the 11 written assignments will be half your final grade. Your grade on the final examination will be the other half.

See the form at the back of this manual for instructions on scheduling the final examination. You must pass the final examination to pass the course.

## **List of Units**

- Unit 1: Collection and Analysis of Information
- Unit 2: Random Variables and Their Probability Models
- Unit 3: Applications of Sampling Theory and Statistical Inference Procedures
- Unit 4: Design and Analysis of Experiments
- Unit 5: Model Fitting and Diagnosis