

Introduction to Statistical Control and Optimization

Offered in 114-2 | New

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Serial Number
58730

Course Number
IE5049

Course Identifier
546 U6130

No Class

3 Credits

Elective
DEPARTMENT OF MECHANICAL ENGINEERING / Master Program in Statistics of Nati... ▼

CHENG-KANG CHEN ▼

Tue 7, 8, 9

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Type 2

100 Student Quota
NTU 94 + non-NTU 6

🇬🇧 English

↔ NTU COOL

↔ Core Capabilities and Curriculum Planning

The course is conducted in English ◦

📖 Notes

Enrolled	Remaining	Registered
45 / 94	49	0

↗ NTU Enrollment Status

This course will introduce how to use statistical methods to control and optimize processes, such as product design, production and operation. The first part of this course will be dedicated to introducing Statistics in such a way students without relevant background can easily understand. The second part of this course then applies the essential idea of statistical estimation and hypothesis testing to process monitoring and control. The third part is to introduce the Design of Experiment (DOE) and Regression Analysis methods for applications in statistical optimization of processes. Throughout the course students will learn how to use Excel to analyze data from real-world cases, such as semiconductor manufacturing data and service operation data, using methods taught in

the class.

Course Outline:

I. Review of Statistics (5 classes)

Outcome Space, Events, Permutation, and Combination

Random Variables

Conditional Probability and Bayes Theorem

Probability Distribution Models

Central Limit Theorem

Purpose and Nature of Sampling

Descriptive Statistics

Q-Q Probability Plot

Statistics and Point Estimate

Moment Estimate

Maximum Likelihood Estimate

Statistical Confidence Interval

Statistical Hypothesis Testing

Testing Means

Testing Variances

Testing Proportions

Course Description

II. Statistical Process Control (5 classes)

Conceptual Framework

Construction of Shewhart Control Charts

Shewhart Control Charts for Attribute Data

Interpretation of Shewhart Control Charts

Importance of Rational Grouping and Sampling

Control Charts for Individual Measurements

CUSUM and EWMA Control Charts

Closing the Control Loop

Process Capability Assessment

III. Statistical Optimization (5 classes)

Taguchi Method

Conceptual Framework for Robust Design

Planned Experimentation using Orthogonal Arrays

Steps in Robust Design

Design and Analysis of Factorial Experiments

Statistical Analysis of Experimental Results

Regression Analysis and Response Surface

ANalysis Of VAriances (ANOVA)

Two-Level Fractional Factorial Designs

Analysis of Fractional Factorial Experiments

Sequential and Iterative Nature of Experimentation

Response Surface Method (RSM)

Central Composite Design (CCD) and Box-Behnken Design



NTU Course



🕒 Course Objective

The students are expected to know how to use statistical methods to monitor and optimize the processes.

⌘ Course Requirement

Calculus

🕒 Expected weekly study hours before and/or after class

📅 Office Hour

📖 Designated Reading

📖 References

1. Introduction to Probability and Statistics for Engineers and Scientists, S. M. Ross, Elsevier Academic Press.
 2. Probability and Statistics for Engineering and Sciences, J. L. Devore, Brooks/Cole Publishing Company, Monterey.
 3. Statistical Quality Design and Control, by R. E. DeVor, T-h Chang and J. W. Sutherland, Macmillan Publishing Company, New York, 1992.
 4. Quality Engineering Using Robust Design, by M. S. Phadke, Prentice Hall, 1989
 5. Design and Analysis of Experiments, by Montgoery
 6. Introduction to Statistical Quality Control, by D. C. Montgomery, Wiley, 1985
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🎓 Grading

1. NTU has not set an upper limit on the percentage of A+ grades.
 2. NTU uses a letter grade system for assessment. The grade percentage ranges and the single-subject grade conversion table in the NATIONAL TAIWAN UNIVERSITY Regulations Governing Academic Grading are for reference only. Instructors may adjust the percentage ranges according to the grade definitions. For more information, see [the Assessment for Learning Section](#) °
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🗑️ Adjustment methods for students

 [Make-up Class Information](#)

 [Course Schedule](#)

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NTU Course

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