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DOE 1 (COMPARATIVE EXPERIMENTS)

BY ELITE INDIGO

Master the core statistical foundations of experimental design, execute rigorous multi-sample comparison tests, and harness software-driven analysis to maximize manufacturing precision and process stability.

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DOE 1 (Comparative Experiments)

• Program Overview

In modern manufacturing, isolating critical process factors while minimizing testing risks is vital for continuous improvement. This 3-day technical course introduces engineers, statisticians, and quality professionals to Design of Experiments (DOE) focused specifically on comparative experiments. Moving beyond basic observations, participants will master the statistical foundations of hypothesis testing, sample size determination, and data visualization. Utilizing JMP software and custom JSL scripts, teams will gain hands-on experience in executing 1-sample, 2-sample, paired, k-sample, and Randomized Block Design (RBD) comparisons—enabling them to apply proven data-driven methodologies on the job immediately.

• Learning Objectives

By the end of the course, participants will be able to:

- Apply key elements of DOE to correctly identify response variables, prioritize factors, and establish baseline statistical goals.
- Formulate and analyze 1-sample, 2-sample, paired, and k-sample comparative tests to identify statistical and technical significance.
- Utilize Randomized Block Designs (RBD) and JMP software scripts to run complex comparative analyses while isolating background variation.

• Pre-requisites

Vital and Applied Stats 101. Good understanding in basic Statistics (role of Statistics, data type, basic terms and concepts for statistical analysis, common graphical and numerical analyses), and some exposure in area of application. The understanding/exposure allows the learners to follow the class well and be able to apply the knowledge learned on the job immediately after the class. Participants are required to install JMP Software (SAS JMP Pro 16.2 or later) prior the class.

• Duration

Three (3) Full-Day Workshop

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DOE 1 (Comparative Experiments)

Course Schedule (Day 1)

DAY/TIME	DESCRIPTION
30 Minutes	**Opening & Introduction**

4 Hours	**Module 1: DOE Overview**
	• What is DOE?
	• Why do we use DOE?
	• How to implement DOE?
	  ◦ Plan the experiment
	  ▪ Define the objectives
	  ▪ Identify response variables
	  ▪ Identify relevant factors
	  ▪ Classify and prioritize factors
	  ▪ Design the experiment
	  ◦ Execute the experiment
	  ◦ Statistically analyze and interpret the data
	  ◦ Take action based on data
	• Important Elements in DOE?
	  ◦ Hypothesis Testing
	  ◦ α and β Risks
	  ◦ Technical Delta and Technical Significance
	  ◦ Sample Size
	• Data Analysis Outcome
	• The Importance of Data Visualization

1 Hour	**Lunch**
3 Hours	**Module 2: 1-Sample Comparison** • Purpose • Hypothesis Testing Steps • 1-Sample Comparison BKM Analysis using JSL Script and Minimum Required Outputs • 1-Sample Comparison Flow • Critical Factors Affecting Sample Size • Sample Size Determination • Operating Characteristic (OC) Curves • 1-Sample Comparison Summary

DOE 1 (Comparative Experiments)

Course Schedule (Day 2)

DAY/TIME	DESCRIPTION
30 Minutes	**Recap of Day 1**

4 Hours	**Module 3: 2-Sample Comparison**
	• Purpose
	• Advantage over 1-Sample Comparison
	• Hypothesis Testing Steps
	• 2-Sample Comparison BKM Analysis using JSL Script and Minimum Required Outputs
	• 2-Sample Comparison Flow
	  ◦ Brown-Forsythe Test: Equality of Variances
	  ◦ T-test: Equality of 2 Means
	  ◦ 100 (1 - α)% Confidence Interval for $\mu_1 - \mu_2$
	• 2-Sample Comparison with Lot Structure Example using JSL Script
	• Technical Equivalency, Final Risk Assessment
	• Sample Size Determination
	• 2-Sample Comparison Summary

1 Hour	**Lunch**

3 Hours	**Module 4: Paired Comparison**
	• Purpose
	• Advantages over 2-Sample Comparison
	• Introduction and Case Study
	  ◦ What Not to Do?
	  ◦ What to Do?
	• Paired Comparison BKM Analysis using JSL Script and Minimum Required Outputs
	• Paired Comparison Flow
	• Sample Size Determination
	• Paired Comparison Summary

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DOE 1 (Comparative Experiments)

Course Schedule (Day 3)

DAY/TIME	DESCRIPTION
30 Minutes	**Recap of Day 2**

4 Hours	**Module 5: k-Sample Comparison**
	• Purpose
	• Hypothesis Testing Steps
	• k-Sample Comparison BKM Analysis using JSL Script and Minimum Required Outputs
	• k-Sample Comparison Flow
	  ◦ Brown-Forsythe Test: Equality of Variances
	  ◦ Analysis of Variance (ANOVA)
	  ◦ Multiple Comparison Analysis Assuming Equal Variances
	• Sample Size Determination
	• k-Sample Comparison Summary

1 Hour	**Lunch**

3 Hours	**Module 4: Randomized Block Design (RBD) Comparison**
	• Purpose
	• Advantages over k-Sample Comparison
	• Introduction and Case Study
	  ◦ What Not to Do?
	  ◦ What to Do?
	• RBD Comparison BKM Analysis using JSL Script and Minimum Required Outputs
	• RBD Comparison Flow
	  ◦ Brown-Forsythe Test: Equality of Variances
	  ◦ ANOVA and Two Way ANOVA Table
	  ◦ Multiple Comparison Analysis Assuming Equal Variances
	• Sample Size Determination
	• RBD Comparison Summary

	Summary & End of Course

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