predictum®

Modern Mixture Experimentation Course Curriculum

Overview

The focus of the Modern Mixture Experimentation (MME) course is on designing and analyzing mixture experiments that enable you to predict and optimize system characteristics, which are critical to product and process design and quality. Products and processes that involve mixtures of liquids, solids, or gases are pervasive and impact the sustainability of your organization. Mixture systems involve inherent constraints and complex kinetics, thereby making their behavior difficult to characterize and predict.

The MME course introduces an innovative and cost-effective approach to designing and analyzing mixture experiments. It provides a solid foundation for designing experiments that are much smaller and more cost-effective than traditional classical designs. You will apply a modern machine learning method, Self-Validating Ensemble Modeling (SVEM), to build accurate and stable predictive models of system behavior, using small data sets. The final topics in the course cover advanced mixture designs and analysis. A variety of design situations and numerous case studies will show you how to apply the methodology and demonstrate how well it works in practice.

For participants who encounter functional responses in their industry, an optional half-day session can be added to the course to cover this specialized topic.

Available delivery methods

- Virtual live
- On-site for corporate groups
- Virtual on-demand (coming soon)

Duration

3 days (24 hours)

Add-on options

- Half-day session covering functional responses
- Virtual office hours with instructors for questions, feedback, and discussion
- Consulting services for project work and specific requirements

Benefits

- Certificate awarded to each participant on completion of course
- A four-month, non-transferrable SVEM application license included for each participant. SVEM is run using JMP (standard) software, for which a trial license is available.
- Course materials including video recordings and slides
- Corporate discount for group registrations from the same organization—please enquire
- Flexible options for delivery method and scheduling

Audience

Engineers, scientists, and researchers who work with mixtures, including chemical, specialty chemical, pharmaceutical, biotechnology, semiconductor, solar, consumer products, and automotive, and other industries that involve work with mixture designs and processes

Prerequisites

No prior, formal training in design of experiments is assumed. Some familiarity with basic statistics is desirable. Options for gaining basic knowledge of statistics are available for participants without this background.

Key Outcome

You and your team will have the methodology and tools to construct cost-effective mixture experiments and fit accurate and stable models, thereby enabling you to leverage these models.

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What You Will Learn

Mixture experiment terminology and applications
Shortcomings of classical mixture designs and approaches
Self-Validating Ensemble Modeling (SVEM) methodology for analyzing mixture experiments
Use of space-filling designs for a wide range of mixture situations
Optimization of the response surface over the design space
Optimization for multiple responses
Mixture and process factor experiments
Mixture of mixture experiments

Course Topics

Note: The following list of topics can be tailored to the specific needs of your organization.

Day 1 (8 hours)

About the Modern Mixture Experimentation Course
Factorial versus Mixture Designs
Systems Thinking
Mixture Spaces, Components, Blending
Modeling Mixture Experiments
  Case Study: Etch Rate
Types of Mixture Designs
  Case Study: Yarn
  Case Study: Etch Rate (Space-Filling Design)
Exercise: Construct a Space-Filling Design
Modern Machine Learning

Day 2 (8 hours)

Modern Machine Learning Example
Self-Validating Ensemble Modeling
Self-Validating Ensemble Modeling (SVEM) Add-In
Saving Profiler Scripts
Exercise: Conduct a SVEM Analysis
Bounds on Components
  Case Study: Flare (Bounds)
  Case Study: Flare (Linear Constraints)
Classical vs Modern Mixture Experimentation
  Example: Waste Glass
Responses, Factors, and Constraints Tables

Day 3 (8 hours)

Mixture of Mixtures Experiments
  Case Study: Photoresist Blending
  Case Study: Harvey Wallbanger
Exercise: Superfood Drink
Optimization and Multiple Responses
  Case Study: Detergent
  Case Study: High Alloy Steel
Mixture-Process Factor Experiments
  Case Study: Fly Ash
  Case Study: Fabric Finish

Additional Session on Functional Responses (4 hours)

Modeling Functional Responses
  Case Study: Fly Ash Curves (Fit Curve)
Functional Responses and Functional Data Explorer (FDE)*
  Case Study: Fly Ash Curves (FDE)*

* Exercises use JMP Pro software, for which an evaluation license is available.

How to Register

If you would like to register for this course or receive more information, please fill out the contact form on Predictum's website, or please send an email with your contact information and request to: training@predictum.com