Design of Experiments (DOE)

Design of Experiment (DOE) is a powerful technique for process troubleshooting, process optimization, and process characterization. Design of Experiments (DOE) is used to determine the key process variables influencing the quality characteristics. DOE is an approach to systematically varying the input variables and observing the effect these variables have on the response variable. Designed experiments are helpful in reducing the variability in the process. They help to determine the variables that can be controlled to optimize the process performance. Using DOE techniques, the important input variables that affect the process output are identified and the relationship between the key input variables and the output variable is modeled. Once the key input variables are identified, the on-line or in-process control techniques are used to control these variables. The objectives of the experimental design are one or more of the following: (i) identify the key input variables that are more influential on the response variable, (ii) determine through modeling, thelevels at which to set the input variables to get the desired output, and (iii) determine the levels of key input variables that will reduce the variability in the output.

The DOE techniques can be used for

- process troubleshooting,
- process characterization,
- process optimization,and
- process improvement.

Upon completion of the course, you will be able to understand:

- the fundamental of Design of Experiment (DOE) including the basic principles, why and where to use DOE, and statistical techniques in DOE
- the simple comparative experiments
- experiments to compare several treatments including the fixed effects model, random effects model, computer analysis of simple designs
- model adequacy checking for one-factor designs, regression approach to ANOVA, and fitting response curve in one-factor design
- Block Designs, computer analysis of randomized block design including the regression model, and the Latin Square Design

- Factorial Experiments and other methods for process improvement including two-factor, three-factor and general factorial designs, fitting response curve and surfaces, computer analysis of two-factor and general factorial designs

- 2k and 3k designs, analysis of 2k factorial designs, general 2k designs and computer analysis

- Fractional Factorial Regression analysis and model building in these designs, and Designs

- Response surface methodology.