

*Title : Design and Analysis of Experiments*

*Code : SYSE-817*

*Credit Hours: 3-0*

**Description:** This course aims at the methodology and problem solving techniques for System engineers via designing/layout and analysis of experiments in standard and non-standard situations. The course will entail the core-disciplines of Applied Statistics. Specifically, the theories, application and importance resulted by randomization and designing for the contrasts of interest and the actual experimental situation will be taught in this course.

**Objectives:** Objectives of the proposed course are to:

1. Describe the basic principles behind designed experiments
2. Show the relationship between a designed experiment, the underlying linear model and the analysis of the resulting data
3. Construct the design matrix for a simple experiment and estimate the model parameters
4. Perform an analysis of variance on standard experimental designs
5. Distinguish between different types of design and recognize their efficiency / utility
6. Perform diagnostic tests on the results from a designed experiment.
7. Explain the underlying theory of different factorial designs, and implement such designs in practice.

**Course Contents:** Suggested contents of the course are:

1. Concept of experiment. Planning of experiment. Design of experiment and its terminology. Principles of experimental designs. Analysis of Variance (ANOVA). Inference about means after ANOVA. Multiple comparison tests: LSD test, Duncan's test, Tuckey's test, Scheffe's test, Orthogonal contrast test. Transformations.
2. Layout and analysis of Completely Randomized, Randomized Complete Block, Latin Square and Graeco-Latin Square designs. Estimation of missing observations. Relative efficiency of these designs. Fixed, Random and Mixed effect models. Expected mean squares deviations. Partitioning of treatment and error SS. Orthogonal Polynomials.
3. Covariance analysis for Completely Randomized, Randomized Complete Block and Latin Square designs; single and double covariates.
4. Factorial experiments and its advantages.  $p \times q$  Factorial in Randomized Complete Block designs. 2nd series Factorial experiments. Linear and quadratic components of main effects and interactions.
5. Balanced Incomplete and Partially Balanced Incomplete Block designs. Comparison of Incomplete Block design with Randomized Complete Block design.

**Text Books/Reference Material:**

1. Montgomery, D.C. (1997) “The Design and Analysis of Experiments”. John Wiley and Sons, New York, Fourth Edition.
2. John, J.A. and Quenoville M.H. (1977) “Experiments Design and Analysis”, Second Edition, Charles Griffin & Co. London.
3. Jeff Wu, C.F. (2002) “Experimental: Planning Analysis” Wiley N.Y.
4. Kuehl, R.O. (2000) “Design of experiments: Statistical principles of research design and analysis” Duxbury, Boston.