

Experimental Design and Data Analytics

CHE-435	Subject: Experimental Design and Data Analytics	2CH	
		Theory (2)	
Pre-req.	Nil	Category	Elective
Course Contents as per PEC Guidelines 2023- 2024			
Strategies for Experimentation with Multiple Factors: Introduction, Classical versus Statistical Approaches to Experimentation, Diagnosing the Experimental Environment, Example of a Complete Experimental Program Statistics and Probability: Introduction, Graphical and Numerical Summaries of a Single Response-Variable, Graphical and Numerical Summaries of the Relation Between Variables, Using Theory to Help Interpret Experimental Data Basic and Advanced Two-Level Factorial Experiments: Two- Level Factorial Design Geometry, Main Effect Estimation, Interactions, Randomization, Number of Replicates Needed for Desired Precision General Factorial Experiments and ANOVA: Mathematical Model for Multiple Level Factorials, Testing the Significance of Main effects and Interaction Effects, Analysis of Blocked and Split- Plot Factorial Experiments with Multilevel Factors, Comparison of Means after the ANOVA Screening Designs: Cause-and-Effect Diagrams, Fractionating Factorial Designs, Fractional Factorial Designs, Plackett-Burman Screening Designs. Screening Designs with Multiple Level Factors Regression Analysis: Method of Least Squares, Linear Regression, Multiple Regression, Quantifying Model Closeness, Checking Model Assumptions, Data Transformation for Linearity Response Surface Designs and Response Surface Model Fitting: Response Surface Concepts and Methods, Empirical Quadratic Model, Design Considerations, Central Composite Designs, Statistical Check of Model Adequacy-Lack of Fit, Analytical Interpretation of Response Surfaces, Numerical Methods for Interpreting Response Surfaces			

Weekly Plan

Week /Lecture	Topic
1-2	Strategies for Experimentation with Multiple Factors: Introduction, Classical versus Statistical Approaches to Experimentation, Diagnosing the Experimental Environment, Example of a Complete Experimental Program
3-5	Statistics and Probability: Introduction, Graphical and Numerical Summaries of a Single Response-Variable, Graphical and Numerical Summaries of the Relation Between Variables, Using Theory to Help Interpret Experimental Data
6-8	Basic and Advanced Two-Level Factorial Experiments: Two-Level Factorial
	Design Geometry, Main Effect Estimation, Interactions, Randomization, Number of Replicates Needed for Desired Precision
9	MID TERM
10-11	General Factorial Experiments and ANOVA: Mathematical Model for Multiple Level Factorials, Testing the Significance of Main effects and Interaction Effects, Analysis of Blocked and Split-Plot Factorial Experiments with Multilevel Factors, Comparison of Means after the ANOVA
12-13	Screening Designs: Cause-and-Effect Diagrams, Fractionating Factorial Designs, Fractional Factorial Designs, Plackett-Burman Screening Designs. Screening Designs with Multiple Level Factors
14-16	Regression Analysis: Method of Least Squares, Linear Regression, Multiple Regression, Quantifying Model Closeness, Checking Model Assumptions, Data Transformation for Linearity Response Surface Designs and Response Surface Model Fitting: Response Surface Concepts and Methods, Empirical Quadratic Model, Design Considerations, Central Composite Designs, Statistical Check of Model Adequacy-Lack of Fit, Analytical Interpretation of Response Surfaces, Numerical Methods for Interpreting Response Surfaces
17	Revision
18	End Semester Exam
TEXT AND REFERENCE BOOKS: - John Lawson and John Erjavec, Basic Experimental Strategies and Data Analysis for Science and Engineering, CRC Press,2017 - Denis Constales, Gregory S. Yablonsky, Dagmar R. D'hooge, Joris W.Thybaut,Guy B.Marin, Advanced Data Analysis and Modelling in Chemical Engineering, Elsevier Science,2016	

