

INSTITUTE	FACULTY OF TECHNOLOGY
PROGRAM	MASTER OF TECHNOLOGY in CHEMICAL ENGINEERING
SEMESTER	3
COURSE TITLE	DESIGN OF EXPERIMENTS AND PARAMETER ESTIMATION
COURSE CODE	01CM0308
COURSE CREDITS	3

Objective:

- 1 To impart comprehensive knowledge on the fundamentals and advanced concepts of Design of Experiments (DOE) and to equip students with skills to analyze experimental data statistically and interpret results effectively.

Course Outcomes: After completion of this course, student will be able to:

- 1 Apply fundamental principles of experimental design in chemical engineering contexts.
- 2 Execute experiments systematically to evaluate process variables
- 3 Employ statistical methods for analysis and interpretation of experimental data
- 4 Optimize chemical engineering processes using advanced DOE methodologies and parametric analyses

Pre-requisite of course: Knowledge of chemical engineering concept and principles and good hands-on on experimental methods.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	Introduction to Experimental Design and Statistical Fundamentals Basics of experimentation, Principles and significance of DOE, Types of experimental designs: Completely Randomized, Randomized Block, Latin Square, Applications in chemical engineering, Probability distributions (Normal, Binomial, Poisson), Hypothesis testing (t-test, F-test, Chi-square test), Confidence intervals, Regression analysis basics	12
2	Factorial and Fractional Factorial Designs Full factorial designs, Analysis of variance (ANOVA), Fractional factorial designs: concept and analysis, Aliasing and confounding effects, Application examples in process optimization	10

Contents : Unit	Topics	Contact Hours
3	Response Surface Methodology (RSM) Introduction to RSM, Central composite designs (CCD), Box-Behnken designs, Modeling and optimization using response surface methods, Interpretation and validation of results	8
4	Advanced Parametric Analysis Techniques Taguchi methods: Orthogonal arrays, Signal-to-noise ratio, Robust design principles, multi-objective optimization approaches, Case studies in chemical engineering processes using Software	10
Total Hours		40

Textbook :

- 1 Applied Design of experiments and Taguchi methods, • Krishnaiah K, Shahabudeen P., PHI learning Pvt Ltd., 2012

References:

- 1 Design and analysis of experiments, Design and analysis of experiments, Montgomery, D. C., John wiley & sons., 2017
- 2 Statistics for experimenters, Statistics for experimenters, Box, G. E., Hunter, J. S., & Hunter, W. G. , In Wiley series in probability and statistics. Hoboken, NJ: Wiley, 2005
- 3 Response surface methodology: process and product optimization using designed experiments, Response surface methodology: process and product optimization using designed experiments, Myers, R. H., Montgomery, D. C., & Anderson-Cook, C. M., John wiley & sons., 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Instructional Method:

- 4 Students will use supplementary resources such as online videos, NPTEL videos, ecourses, Virtual Laboratory

Supplementary Resources:

- 1 https://onlinecourses.nptel.ac.in/noc21_mg48/preview