

18 APR 2018 CC/ 28 MAY 2018 UC

DEPARTMENT OF CHEMICAL ENGINEERING
College of Engineering
University of the Philippines Diliman, Quezon City

COURSE SYLLABUS
ChemE 143 Chemical Engineering Research I

A. Course Catalogue Description

1. **Course Number:** ChemE 143
2. **Course Title:** Chemical Engineering Research I
3. **Course Description:** Application of selected topics in Design of Experiments to chemical engineering research; conceptualization and proposal writing for a chemical engineering research project
4. **Prerequisite:** ChemE 135 Process Engineering Laboratory
5. **Semester Offered:** Second Semester
6. **Course Credit:** 2u
7. **Number of Hours:** 1h lec, 3h lab
8. **Meeting Type:** lecture, laboratory
9. **Course Goals:** To discuss the application of selected methods in Design of Experiments to interpret experimental data and the method of develop a research proposal.

B. Rationale

This course introduces concepts in Design of Experiments that can be applied in conducting research in different chemical engineering disciplines. It also enables students to develop basic laboratory safety habits and their skills in writing a methodology prior to performing laboratory experiments.

C. Course Outline

1. Course Outcomes (CO)

Upon completion of the course, students must be able to:

- CO 1. design experiments;
- CO 2. analyze experimental data using appropriate statistical methods;
- CO 3. write a research project proposal; and
- CO 4. successfully present their research proposal in a public forum.

Course Outcomes and Relationship to Program Learning Objectives

Course Outcomes	Program Learning Objectives*				
	A	B	C	D	E
Design experiments					
Analyze experimental data using appropriate statistical methods					
Write a research project proposal					

18 APR 2018 CC/ 28 MAY 2018 UC

Course Outcomes	Program Learning Objectives*				
	A	B	C	D	E
Successfully present their research proposal in a public forum					

- * **A** Equip students with strong technical education in chemical engineering necessary to succeed in their chosen careers and to become responsive citizens.
- B** Develop the students' ability to effectively communicate technical information to any audience.
- C** Train students to function in multidisciplinary teams, manage projects, and take leadership roles in their respective fields.
- D** Engage students in research, innovation, and life-long learning to identify opportunities, and address issues and challenges in their respective spheres of influence.
- E** Instill in students a strong commitment to the ethical practice of their profession; to health, safety, and environment; and to service to society.

2. Course Content

Topics	No. of Hours	
	Lec	Lab
Laboratory methods in chemical engineering 1. Health and safety protocols in the laboratory 2. Review of health and safety protocols	1	3
Introductory statistics 1. Mean, median and mode 2. Measures of variability 3. Normal distribution	3	9
Hypothesis testing 1. Statistical inference and hypotheses 2. Statistical estimation	2	6
Analysis of variance (ANOVA)	2	6
Exploratory data analysis 1. Regression analysis a. Linear regression b. Multiple regression c. Non-linear regression 2. Correlation analysis a. Linear regression b. Multiple linear regression	2	6
Long Examination 1		
Introduction to Design of Experiments (DOE) 1. Strategies for experimentation 2. Selection of factors, responses and levels 3. Measurement of errors of factors and responses 4. DOE methods	3	9
Factorial design 1. Full factorial 2. Fractional factorial	3	9
Long Examination 2		
Proposal Presentation		
Total number of hours	16	48

3. Course Coverage

Week	CO	LECTURE TOPIC	ESSENTIAL/ KEY QUESTIONS	Suggested Teaching and Learning Activities	Suggested Assessment Tools
1	1	Laboratory methods in chemical engineering 1. Health and safety protocols in the laboratory 2. Review of health and safety protocols	What are the standard laboratory protocols for health and safety before, during and after any chemical experiment?	lecture, classwork, consultation	quiz
2-4	2	Introductory statistics 1. Mean, median and mode 2. Measures of variability 3. Normal distribution	What are the basic statistical concepts needed to analyze data for research?	lecture, classwork	quiz
5-6	1	Hypothesis testing 1. Statistical inference and hypotheses 2. Statistical estimation	What are the different methods for testing the validity of a hypothesis?	lecture, classwork	quiz
7-8	1	Analysis of variance (ANOVA)	What is ANOVA?	lecture, classwork	quiz
9-10	2	Exploratory data analysis 1. Regression analysis a. Linear regression b. Multiple regression c. Non-linear regression 2. Correlation analysis a. Linear regression b. Multiple linear regression	How are experimental data analyzed and interpreted? How are errors measured and analyzed?	lecture, classwork	quiz
					Long Examination 1
11-13	1	Introduction to Design of Experiments (DOE) 1. Strategies for experimentation 2. Selection of factors, responses and levels 3. Measurement of errors of factors and responses 4. DOE methods	What is DOE? What are the different methods of designing an experiment?	lecture, classwork	quiz
14-16	1,3	Factorial design 1. Full factorial 2. Fractional factorial	What is a full factorial design? What is a fractional factorial design?	lecture, classwork	quiz
					Long Examination 2
		Proposal Presentation	What are the contents of a research proposal?	oral presentation	proposal manuscript, oral presentation

18 APR 2018 CC/ 28 MAY 2018 UC

4. Course Requirements

1. Long examinations (2)
2. Quizzes
3. Proposal manuscript
4. Oral presentation

REFERENCE:

- Department of Chemical Engineering (2015). Laboratory Safety Manual. University of the Philippines Diliman.
- Lazic, Z. R. (2004). *Design of Experiments in Chemical Engineering: A Practical Guide*. Weinheim, Germany: Wiley-VCH Verlag GmbH & Co. KGaA.
- Montgomery, D.C. (2017). *Design and Analysis of Experiments* 9th Ed. NJ: John Wiley and Sons Inc.
- Ramirez, J. C. C. (2016). Analysis and optimization of water-based printing ink formulations for polyethylene films (Master's thesis). University of the Philippines Diliman.