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

COURSE SYLLABUS
ChemE 135 Process Engineering Laboratory

A. Course Catalogue Description

1. **Course Number:** ChemE 135
2. **Course Title:** Process Engineering Laboratory
3. **Course Description:** Experiments on applications of thermodynamics and physical chemistry; experiments on heat transfer and momentum transfer
4. **Prerequisite:** ChemE 123 Chemical Engineering Thermodynamics II
   ChemE 130 Process Fluid Systems
   ChemE 131 Thermal Systems and
   Chem 28.1 Fundamentals of Analytical Chemistry Laboratory
5. **Semester Offered:** First Semester
6. **Course Credit:** 2u
7. **Number of Hours:** 6h
8. **Meeting Type:** laboratory
9. **Course Goals:** To reinforce the students' learning on the different fundamental concepts of thermodynamics, heat transfer and momentum transfer through simple practical chemical engineering experiments and enhance their problem definition and problem-solving skills, and to improve the students' ability to make calculations, obtain correct experimental data and present them effectively

B. Rationale

This course provides an opportunity for students to observe the practical application of heat transfer, momentum transfer and thermodynamics to laboratory scale versions of chemical systems and unit operation equipment (e.g., mixing of solutions in a heated tank, flow of fluids in pipes).

C. Course Outline

1. Course Outcomes (CO)

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

- **CO 1.** perform experimental procedures on physical chemistry, chemical engineering thermodynamics, heat transfer, and fluid dynamics;
- **CO 2.** apply good laboratory practices with regards to health, safety, and environment when conducting experiments;
- **CO 3.** analyze experimental data using previously learned chemical engineering principles;
- **CO 4.** communicate the results of experiments in a written formal report and an effective oral presentation;
- **CO 5.** perform experiments in teams; and

CO 6. evaluate their own and their group members' performance.

Course Outcomes and Relationship to Program Learning Objectives

Course Outcomes	Program Learning Objectives*				
	A	**B**	**C**	**D**	**E**
Perform experimental procedures on physical chemistry, chemical engineering thermodynamics, heat transfer, and fluid dynamics	■				
Apply good laboratory practices with regards to health, safety, and environment when conducting experiments.	■				■
Analyze experimental data using previously learned chemical engineering principles	■				
Communicate the results of experiments in a written a formal report and an effective oral presentation	■	■			
Perform experiments in teams			■		
Evaluate their own and their group members' performance		■	■		

* **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

Sample Laboratory Topics	No. of Hours
Experiments on thermodynamics and physical chemistry 1. Latent heat of vaporization and saturation temperature (Ramsay-Young method) 2. Vapor-liquid equilibrium 3. Liquid-liquid equilibrium (ternary system) 4. Partial molar volume of an aqueous solution 5. Flash point determination of an alcohol (open cup method)	30
Experiments on momentum transfer 1. Centrifugal pumps 2. Reynolds experiment 3. Valves and fittings 4. Flow metering 5. Fluidized bed	30

Sample Laboratory Topics	No. of Hours
Experiments on heat transfer 1. Thermal conductivity 2. Composite slabs 3. Radiation 4. Free convection 5. Finned tubular heat exchangers	30
Oral Presentation	6
Total number of hours	**96**

3. Course Coverage

Week	CO	TOPIC	ESSENTIAL/ KEY QUESTIONS	Suggested Teaching and Learning Activities	Suggested Assessment Tools
1-5	1,2 3,4,5,6	**Experiments on thermodynamics and physical chemistry** 1. Latent heat of vaporization and saturation temperature (Ramsay-Young method) 2. Vapor-liquid equilibrium 3. Liquid-liquid equilibrium (ternary system) 4. Partial molar volume of an aqueous solution 5. Flash point determination of an alcohol (open cup method)	What are the principles of thermodynamics and physical chemistry being demonstrated by the experiments? What are the possible sources of error in the experimental data?	laboratory experiment	formal report, laboratory performance assessment
6-10	1,2 3,4,5,6	**Experiments on momentum transfer** 1. Centrifugal pumps 2. Reynolds experiment 3. Valves and fittings 4. Flow metering 5. Fluidized bed	What are the principles of momentum transfer and fluid dynamics being demonstrated by the experiments? What are the possible sources of error in the experimental data?	laboratory experiment	formal report, laboratory performance assessment
11-15	1,2 3,4,5,6	**Experiments on heat transfer** 1. Thermal conductivity 2. Composite slabs 3. Radiation 4. Free convection 5. Finned tubular heat exchangers	What are the principles of heat transfer being demonstrated by the experiments? What are the possible sources of error in the experimental data?	laboratory experiment	formal report, laboratory performance assessment

Week	CO	TOPIC	ESSENTIAL/ KEY QUESTIONS	Suggested Teaching and Learning Activities	Suggested Assessment Tools
16	1,3,4	**Oral presentation**	How do you effectively communicate the experimental results to an audience of peers?	student oral report	oral report

4. Course Requirements

Formal reports
Oral report
Laboratory performance assessment

REFERENCES:

Casin A., Cruz, F., Ramos, S.L.R. (2017). Development and performance testing of laboratory experiments and equipment for the Chemical Engineering Laboratory (Undergraduate research). University of the Philippines Diliman.

Geankoplis, C. J., Hersel, A. H., and Lepek, D. H. (2018). *Transport Processes and Separation Process Principles* 5th Ed. London, UK: Pearson Higher Education.

McCabe, W.L., Smith, J.C. and Harriott, P. (2005). *Unit Operations of Chemical Engineering* 7th Ed. NY: McGraw-Hill Co., Inc.

Serth, R. W. and Lestina, T. (2014). *Process Heat Transfer: Principles, Applications and Rules of Thumb* 2nd Ed. MA: Academic Press.

Smith, J. M., Van Ness, H. C. and Abbott, M. M. (2018). *Introduction to Chemical Engineering Thermodynamics* 8th Ed. NY: McGraw-Hill Co., Inc.

Towler, G. and Sinnott, R. (2012). *Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design* 2nd Ed. Oxford, UK: Butterworth-Heinemann.