Department of Chemical Engineering
College of Engineering
University of the Philippines
Diliman, Quezon City

ChE 126

Chemical Reaction Engineering II

Course Description: Catalysis. Heterogeneous reactors. Application of kinetics and thermodynamics to selected unit processes.

Course Prerequisites: ChE 125 and ChE 131

Course Credit: 3.0 units (3 h lecture)

Program Educational Objectives (BS Chemical Engineering)
The program aims to educate students such that three to five years from graduation, they:

1. take leadership roles in their respective fields and/or effectively work in or manage a team;
2. are equipped with the extensive knowledge and relevant skills necessary to succeed in their chosen careers and to become responsive citizens;
3. are able to demonstrate strong research & innovative capability as they recognize and address opportunities and challenges in their respective spheres of influence;
4. have shown strong commitment to the ethical practice of their profession; to health, safety and environment; and service to society.

Course Outcomes
At the end of the course, the student should be able to:

1. Apply the concepts of chemical kinetics and transport phenomena in determining the overall kinetic equations of heterogeneous reactions
2. Describe the nature of fluid-solid catalytic reactions
3. Differentiate the nature of fluid-solid catalytic reactions from homogeneous reactions
4. Describe the nature of reactions on porous catalysts
5. Design heterogeneous reactors for desired process requirements

Student Outcomes Satisfied by Course Outcomes

[a] Ability to apply knowledge of mathematics and science to solve engineering problems

[c] Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards

[e] Ability to identify, formulate, and solve engineering problems

Course Content

1. Heterogeneous processes, Catalysis, Adsorption (Chapter 7 Smith)
2. Rate Equations for Fluid-Solid Catalytic Reactions (Chapter 7 Vannice, Chapter 5 Davis & Davis)
    a. Reaction models with RDS
    b. Reaction models with no RDS
    c. Kinetic Parameter Estimation
    d. Catalyst Poisoning
3. Solid Catalysts (Chapter 8 Smith)
    a. Surface area estimation by BET
    b. Pore Volume Distribution

First Long Exam

4. External Transport Processes in Heterogeneous Reactions (Chapter 10 Smith, Chapter 6 Davis & Davis)
    a. Effect of Physical Processes on Global Rate
    b. Quantitative Treatment of Eternal Transport Effects (Review: Heat and Mass Transfer coefficients)
    c. Effect of External Transport on Selectivity
5. Internal Transport Processes in Heterogeneous Reactions (Chapter 11 Smith, Chapter 6 Davis & Davis)
    a. Diffusion in Cylindrical Pore
    b. Diffusion in Porous Catalysts
    c. Surface Diffusion
    d. Effectiveness Factor (Isothermal/Non-isothermal)
    e. Effect of Internal Transport on Global rate

Second Long Exam

6. Design of Heterogeneous Catalytic Reactors (Chapter 13 Smith)

Third Long Exam

Course Assessment

Long Examinations (3)	70%
Quizzes, Seatwork, Homework	10%
Project	20%

Course Policies

1. There will be **three (3) long examinations** (LE) in this course.
2. A student who misses an exam must submit an official excuse slip (medical certificate/death certificate) to the instructor on or before the schedule of the next long exam; otherwise a score of **zero (0)** will be given for the missed exam. Only **one (1)** excused missed long exam is allowed.
3. The student shall be given **three (3) days** (excluding Saturdays, Sundays and holidays) after the release of exam results to seek corrections. *Any grievance raise after the grace period will not be entertained.*
4. Quizzes and seatwork are given in class. There will be no remedial for any missed in class activity.
5. University rules on cheating/dropping/LOA shall be strictly applied.
6. ***The instructor reserves the right to make changes in the class policies when deemed necessary.***

Grading System

1.00	1.25	1.50	1.75	2.00	2.25	2.5	2.75	3.00	5.00
[92,100]	[88,92)	[84,88)	[80,84)	[76,80)	[72,76)	[68,72)	[64,68)	[60,64)	[0,60)

List of Instructors

Dr. Joey Ocon
Prof. Ralph Villa
Prof. Julie Anne del Rosario
Prof. Jhud Mikhail Aberilla

References

1. Smith, J.M., 1981**. Chemical Engineering Kinetics, 3rd ed. USA: McGraw-Hill, Inc.**
2. Davis, M.E.; Davis, R.J., 2003. **Fundamentals of Chemical Reaction Engineering.** USA, McGraw-Hill Inc.
3. Levenspiel, O., 1999. **Chemical Reaction Engineering**, John Wiley & Sons, Inc.
4. Vannice, A., 2005,. **Kinetics of Catalytic Reactions,** USA, Springer Science + Business Media Inc.