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

ChE 131

Transport Processes

Course Description: Fundamentals of heat, mass, & momentum transport. Differential balances; equations of change. Molecular and turbulent transport systems. Applications to interphase transfer.

Course Prerequisite: ChE 106

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. Identify and describe the transport mechanisms - their flux, the forces that drive them, the resistances that control their rates and the mathematical expressions that relate these - from physico-chemical, biological, and other chemical engineering situations;
2. Develop and operate on appropriate mathematical models describing momentum, heat and mass transfer - from microscopic to macroscopic scale - by selecting relevant mechanisms and initial/boundary conditions which describe the system;
3. Identify and select appropriate literature and data (e.g. transport properties, empirical correlations) in solving governing equations of transport phenomena;
4. Solve differential equations arising from the analysis of transport phenomena and interpret the results in the context of chemical engineering practices (e.g. design, HSE, economics);
5. Use numerical software packages to aid the solution of transport problems, as well as conduct simulation experiments.

Student Outcomes Satisfied by Course Outcomes
[a] Ability to apply knowledge of mathematics and science to solve engineering problems
[e] Ability to identify, formulate, and solve engineering problems

Course Content

WEEK	TOPIC
Week 1	A. Discussion of Class Policies B. Introduction to Transport Phenomena C. Molecular Transport Equations
Week 2	Overall Balances (Momentum, Energy, Mass)
Week 3 & Week 4	A. Introduction to Fluid Flow B. Shell Momentum Balance

Week 5	Equations of Change (Momentum)
Week 6	*Dimensionless Groups* A. Friction Factor B. Reynolds Number *Turbulence/Convective transport
Week 7	Boundary Layer Flow
FIRST LONG EXAMINATION	
Week 8	A. Introduction to Heat Transfer 1. Conduction Heat Transfer 2. Convective Heat Transfer
Week 9	Shell Heat Balance
Week 10 & Week 11	A. Equations of Change (Heat) B. Dimensionless Groups *Convective Heat Transfer
Week 12	Unsteady-state Heat Transfer
SECOND LONG EXAMINATION	
Week 13	A. Introduction to Mass Transfer 1. Molecular Diffusion 2. Convective Mass Transfer
Week 14	Shell Mass Balance
Week 15	A. Equations of Change (Mass) B. Dimensionless Groups *Convective Heat Transfer C. Unsteady-state Mass Transfer
Week 16	A. Interface Mass Transfer B. Momentum, Heat, and Mass Transfer Analogies
THIRD LONG EXAMINATION	
FINAL EXAMINATION	

Course Assessment

Long Examinations (3)	60%
Final Exam	20%
Design Project	15%
Classwork	5%

Course Policies

1. **ATTENDANCE.** University rules on class attendance shall be observed.
2. **EXAMS.** The following policies on long exams shall apply:
   - **a.** The student must submit twelve (9) stapled sheets of colored pad paper (3 green, 3 blue, 3 pink) at least one class meeting before the long exam. The name, student number and section must be written on the upper right portion of the paper. Failure to comply with any of the mentioned rules will automatically result to a 10-point deduction in the exam.
   - **b.** Grievances on the exam shall be entertained 1 week (inclusive of weekends) after the exam is returned.
   - **c.** There will be no make-up Long Exam and make-up Final Exam.
3. **DESIGN PROJECT**. Details will be given at a later date.
4. **The instructor reserves the right to make changes in the course 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. Terence Tumolva
Prof. Julie Anne del Rosario
Prof. Karl Ezra Pilario
Prof. Jhud Mikhail Aberilla
Prof. Jonas Karl Christopher Agutaya
Prof. Ralph Villa
Engr. Bemboy Niño Subosa
Engr. Myron Alcanzare

References

1. Bird, R.B., Stewart, W.E., Lightfoot, E.N. Transport Phenomena. John Wiley & Sons, Inc., New York. 2002.
2. Foust, A.S., Wenzel, L.A., Clump, C.W., Maus, L., Bryce Andersen, L. Principles of Unit Operations. John Wiley & Sons, Inc, Singapore. 1980.
3. Fahien, R. Fundamentals of Transport Phenomena. McGraw-Hill Book Company, New York. 1983.
4. Tosun, I. Modelling Transport Phenomena. 2006.
5. Welty, J.R., Wicks, C.E., Wilson, R.E., Rorrer, G.L. Fundamentals of Momentum, Heat, and Mass Transfer.John Wiley & Sons, Inc., New York. 2008.
6. Geankoplis, C.J. Principles of Transport Processes. Prentice Hall, New Jersey. 2003.