202-511 Advanced Transport Phenomena

Course Syllabus

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1. **Faculty** Engineering **Department** Chemical Engineering

2. **Course ID** 202-511 **Course name** Advanced Transport Phenomena
   3 Credits

Section 1	Tu	13.00-14.30	Room 1518
	W	09.00-10.30	Room 1518

3. **Course description**

Methods of solving transport problems; momentum transfer, heat transfer, and mass transfer; complex systems with (1) complex fluids, (2) interactions of two or more transport processes, (3) multi-phase or phase change, or (4) presences of chemical reactions; steady state and unsteady state transport.

4. **Course objectives**

After this course, student should clearly understand the concepts of transport phenomena and its relationships with other core chemical engineering subjects. Students should be able to develop governing equations for complex system in chemical engineering and solve the problem to describe the velocity, temperature, and concentration field in such system. Activities in this course intend to help students develop critical thinking skills and ability to interpret physicochemical phenomena to and from mathematical expressions.

5. **Course outline**

- Review of related mathematics (i.e., vector/tensor operators, ODEs, PDEs)
- Methods of solution for transport problems
- Concepts of transport phenomena
- Foundations of fluid mechanics
- Selected topics in fluid mechanics
  (Non-Newtonian fluid)
- Foundations of heat and mass transfer
- Selected topics in heat and mass transfer
  (Phase change material)
- Selected topics in applied transport phenomena
  (Multiphase transport and boundary layer theory)

6. **Method**

Lectures, Self-study, Article review/Article critique

7. **Lecture tools**

PowerPoint slide, Whiteboard, Lecture note, Handouts

8. **Course marking scheme**

Midterm exam	40%
Final exam	40%
Article review/critique	
Term paper	10%
Oral exam	10%

9. **Course evaluation (Tentative)**

Summation of adjusted marks will be used to evaluate students' performance.

A	= 80+	B+	= 72.5+
B	= 65+	C+	= 57.5+
C	= 50+	D+	= 42.5+
D	= 35+	F	= 35-

10. **Office hour**

Office: 1409-B
Office hours: Tu 14.30-16.00 and W 10.30-12.00
E-mail: fengsia@ku.ac.th

11. **Reference**s

1. Greenberg, M.D, Advanced Engineering Mathematics, 2nd edition, Prentice-Hall, 1998.
2. Welty, J.R., Wicks, C.E., Wilson, R.E., Fundamentals of Momentum, Heat, and Mass Transfer, 3rd edition, John Wiley & Sons, 1984.
3. Bird, R.B., Stewart, W.E., Lightfoot, E.N., Transport Phenomena, 2nd edition, John Wiley & Sons, 2002.
4. Slattery, J.C., Advanced Transport Phenomena, Cambridge University Press, 1999.
5. Deen, W.M., Analysis of Transport Phenomena, Oxford University Press, 1998.
6. White, F.M., Fluid Mechanics, 3rd edition, McGraw-Hill, 1994.
7. Currie, I.G., Fundamental Mechanics of Fluids, 2nd edition, McGraw-Hill, 1993
8. Schlichting, H., Boundary Layer Theory, 7th edition, McGraw-Hill, 1955.
9. Ozisik, M.N., Heat Conduction, John Wiley & Sons, 1980.
10. Arpaci, V.S., Larsen, P.S., Convection Heat Transfer, Prentice-Hall, 1984
11. Bejan, A., Convection Heat Transfer, 2nd edition, John Wiley & Sons, 1995.

12. **Tentative schedule**

Week	Lecture topics
1	- Course introduction - Review of related mathematics
2	- Methods of solution for transport problems
3	- Key concepts in transport phenomena
4	- Flow kinematics
5	- Continuity equation
6	- Momentum equations
7	- Role of rheology - Non-Newtonian fluid
8	- Navier-Stokes equations
9	Midterm Exam
10	- Energy equation
11	- Energy equation
12	- Simplification and dimensionless form
13	- Multicomponent transport
14	- Multiphase transport - Phase change material
15	- Kaset Fair
16	- Concepts of boundary layer theory
17	- Oral exam
18	Final exam

13. **Instructor**

Asst.Prof.Dr. Siripon Anantawaraskul

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