# ChE 615 Transport Phenomena
## Fall Semester 2013

**Instructor**: Ray Y. K. Yang (Room 441 ESB; ryang@mail.wvu.edu; 304-293-9365)

**Lectures**: 9:00-10:15am, M W (Room 215 ESB); **Office hour**: 2:00-2:50pm, F (Room 441 ESB)

**Course Objective**:
Analyzing, modeling, and solving chemical engineering problems that are related to momentum, heat, and mass transports. Both Shell-Balance Approach and Equations-Of-Change Approach are covered. Analogy among the three types of transports and similarity in the solution methods involved are emphasized.

**Prerequisite**: Undergraduate-level Transport Phenomena course (WVU's ChE 315 or its equivalent); Or instructor's consent.

**Textbook:** Bird, R. B., Stewart, W. E., and Lightfoot, E. N., *Transport Phenomena*, Revised 2nd Ed., 2007, Wiley (Required).

**Course Outline***:

0. Introduction to MATLAB*
   Fundamentals and Graphics of MATLAB

1. Shell-Balance Approach for Heat Transport*
   Review of vector notation/analysis; Molecular heat flux; Fourier's law of heat conduction; Solution of heat-transfer problems; Analysis and interpretation of solution.

2. Shell-Balance Approach for Momentum Transport*
   Tensor notation/analysis; Newton's laws of viscosity; Molecular, convective, and combined momentum fluxes; Non-Newtonian viscosity and the generalized Newtonian models; Solution of momentum-transfer problems; Analysis and interpretation of solution.

3. Shell-Balance Approach for Mass Transport*
   Fick's law of diffusion; Molecular, convective, and combined mass/molar fluxes; Solution of mass-transfer problems with and without chemical reactions; Analysis and interpretation of solution.

4. Equations-of-Change (EOC) Approach for Mass Transport*
   Equations of continuity; Solution of mass-transfer problems with one and two independent variables and with and without chemical reactions; Analysis and interpretation of solution.

5. Equations-of-Change (EOC) Approach for Momentum Transport*
   Equation of motion; Navier-Stokes equation; Equation of continuity; Solution of momentum-transfer problems with one and two independent variables; Analysis and interpretation of solution.

6. Equations-of-Change (EOC) Approach for Heat Transport*
   Equation of energy; Convective and combined heat fluxes; Solution of heat -transfer problems with one and two independent variables; Analysis and interpretation of solution.

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*Topics may not be presented in the same order as shown above.

**Assessment:**

1) Homework problems: 20%

2) Two-hour mid-term examination: 40%

3) Two-hour final examination: 40% (8-10 am, December 17, Tuesday)

**Print Reserves in Evansdale Library for This Course:**

1. Bird, R. B., Stewart, W. E., and Lightfoot, E. N., *Transport Phenomena*, Revised 2nd Ed., 2007, Hard-cover (ISBN:978-0-470-11539-8), Wiley.

2. Pratap, R., *Getting Started with MATLAB – A Quick Introduction for Scientists and Engineers,* 2010, Oxford University Press.

3. Chapra, S., *Applied Numerical Methods with MATLAB,* 3rd Ed., 2012, McGraw Hill.

**Electronic Book Collection at WVU for This Course:**

1. Hahn, B. H. and Valentine, D. T., *Essential MATLAB for Engineers and Scientist*s, 4th Ed., 2010, Academic Press.

**Academic Integrity Statement:**

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me *before* the assignment is due to discuss the matter.

**Social Justice Statement**:

"West Virginia University is committed to social justice. I concur with that commitment and expect to foster a nurturing learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Disability Services.