CHE601 Theory and Application of Transport Phenomena, Fall 2022
Chemical Engineering, University of Waterloo

Instructor:

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Course Description[2]: Mathematical analysis of momentum, heat and mass transport in systems of chemical engineering interest: development of the differential equations of change (continuity, motion and energy) for forced convection in isothermal, non-isothermal and multi- component systems; description of velocity, temperature and concentration profiles and computation of momentum, energy and mass fluxes at surfaces under conditions of laminar flow; description of transport in turbulent flow by time-smoothing of the equations of change; turbulent velocity, temperature and concentration profiles.

Course References:

- **Required:** Transport Phenomena by: Bird, R.; Stewart, W. & Lightfoot, E. John Wiley and Sons (2002)
- **Optional:** Scaling Analysis in Modeling Transport and Reaction Processes by W.B. Krantz. John Wiley and Sons (2006)

Course website - `http://learn.uwaterloo.ca`, the content management system will be used as the main means of communication outside of lectures and tutorials.

Course Schedule:

Lectures	T 14:00-15:20	E6-4022	Midterm	TBD	TBD
	F 12:30-13:50	E6-4022	Final	TBD	TBD

Evaluation: The course grade will be based on 4 homework assignments ($4\times5\% = 20\%$), a midterm examination (20%), and a final examination (60%), held according to the Official Examination Schedule).

The formatting of the homeworks should be as follows:

[1] Also by appointment.

[2] A tentative course schedule with corresponding textbook sections is given on the last page of this outline.

- Completed neatly and legibly; marks will be deducted for any solutions that are not clearly written.
- Only the student ID number appear should on the front page (upper right or left corner) and the full name and ID number should be indicated on the back of the last page of the assignment.
- HW assignments must be submitted *in class* or online when specified, no exceptions other than those mentioned in University policy.

In order to pass the course, your (combined) examination grade must be at least 50%. *If your examination average is below* 50%, *you will receive this grade instead.*

Course Responsibilities:

Talking and Electronic Devices: Disruptions during lecture/tutorials/exams due to talking and/or the use of electronic devices are prohibited. Violations of this policy will be dealt with according to Policy 71 (referenced below).

Academic Integrity, Grievance, Discipline, Appeals and Note for Students with Disabilities: see `http://www.uwaterloo.ca/accountability/documents/courseoutlinestmts.pdf`. The text for this web site is listed below:

- **Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check `http://www.uwaterloo.ca/academicintegrity/` for more information.]
- **Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, `www.adm.uwaterloo.ca/infosec/Policies/policy70.htm`. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.
- **Discipline:** A student is expected to know what constitutes academic integrity [check `http://www.uwaterloo.ca/academicintegrity/`] to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline `http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm`. For typical penalties check Guidelines for the Assessment of Penalties, `http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm`.
- **Appeals:** A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) `http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm`.

- **Note for Students with Disabilities:** The Office for persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.

Tentative Course Schedule

Week	*Lecture Topic*	*Additional Notes*	
1	Scaling of Differential Equations	Krantz 1	
	Tensor Operations and Calculus	BSL AppA	
2	Tensor Operations and Calculus	BSL AppA	
3	Conservation of Mass, Momentum, Energy	BSL 3.1-3,5,11.1-2	
	for single-component systems		
4	Dimensional Analysis of Conservation Eqns.	BSL 3.7,11.5,9	HW1 Due
	for single-component systems		
5	Transport by Molecular Motion	BSL 1.3-5,9.2-4,17.2-5	
6	Momentum Transport	BSL 3.6,4.1-2	
7	Momentum Transport	BSL 4.3-4	HW2 Due
8	Energy Transport	BSL 11.2-4	
9	Conservation Equations for Mixtures	BSL 19.1-3	
10	Transport in Fluid Mixtures	BSL 19.4-5	HW3 Due
11	Transport in Fluid Mixtures	BSL 19.5,20.1	
	Transport in Turbulent Flow	BSL 5.1-3	
12	Transport in Turbulent Flow	BSL 5.4-6, 13.1-2	
13	Transport in Turbulent Flow	BSL 13.3-4, 21.1-4	HW4 Due