Introductory Transport Phenomena **CBE320 (4 credits)** **Spring 2022**

Class meetings	Mon Wed Fri	8:50-9:40 am	1610 Eng Hall
Course website	https://canvas.wisc.edu/courses/281998		
Instructor	Prof. John Yin (john.yin@wisc.edu)		
Office Hour	Tuesdays 12:10-1:10pm, 3633 Eng Hall or by email arrangement		
TAs	Alex Guo	aguo25@wisc.edu	
	Bill Yan	wyan34@wisc.edu	
TA Office Hours:	to be determined after the first class meeting		
Discussion (section)	Mon (301)	1:20-3:15 pm	2321 Eng Hall
	Tues (302)	1:20-3:15 pm	1164 Mech Eng Bldg
	Tues (303)	3:30-5:25 pm	1213 Eng Hall
Textbook	*Introductory Transport Phenomena (2015)*, Wiley R.B. Bird, W.E. Stewart, E.N. Lightfoot and D.J. Klingenberg		

COURSE LEARNING OUTCOMES

- Set up shell balances for conservation of momentum, energy, and mass;
- Understand and apply: flux laws in balances, interphase transport relationships;
- Use shell balance equations to obtain desired profiles for velocity, temperature and concentration;
- Reduce and solve the appropriate equations of change to obtain desired profiles for velocity, temperature and concentration macroscopic balances for conservation of momentum, energy and mass
- Use information from solving balance equations to obtain engineering quantities of interest
- Recognize and apply analogies among momentum, heat and mass transfer,
- Appreciate transport principles in diverse applications of chemical, biological, and materials science and engineering

PIAZZA

For class discussions, will use Piazza, a system designed for efficient communication. As questions arise on course material, you are encouraged to look through existing posts on Piazza, *before* contacting the teaching staff; if you don't see your question addressed, then add a new post to Piazza. **Feel free to post questions or notes anonymously**. Use private posts to the instructors (instead of to the entire class) only for private matters (e.g., special accommodation is needed). If you have any problems or feedback for the developers, email team@piazza.com.

DISCUSSION
Attend the discussion session for which you registered. At each session, you will be given an assignment to be completed by the end of the session. The TA will offer hints or tips. Please try first to work all the problems on your own. Although you may seek advice or guidance from your classmates, you should **submit your own work**.

HOMEWORK
Weekly assignments will be posted on the course website and they will be due each Wednesday at the start of class. Present your work in a consistent format, and start each problem on a new page. Please include the following information at the top of the first page:

Your name, date, course, homework number, and discussion session number.

Late homework will not be accepted. The teaching assistants or graders are under no obligation to grade sloppy or illegible homework. **Do the homework!** This is the best way to develop your understanding of the course material. Feel free to discuss problems with your classmates, the TA or the professor. However, invest significant effort on you own before you seek help; **homework submissions should be your own work. Don't be a cheater!** Penalty levels for copying homework are progressively more stringent: (1st offense) zero credit for that week's homework and elevation of your status to "close-watch potential cheater," (2nd offense) zero credit for ALL homework & discussion equivalent to 15% of your course grade, (3rd offense) course grade F. Similar penalties hold for cheating on exams.

GRADING	Three term exams	39%
	Final exam	31%
	Homework	15%
	Discussion	15%
	Bonus point	up to 1% **

* Course policy on replacing lowest term exam score. There will be three exams during the term and one comprehensive final exam. Each term exam will be normalized by dividing it by the class average. Your lowest normalized score will be dropped and replaced by your next highest normalized score. For example, if your scores were 90, 67, 82, and the class averages on these exams were 70, 60, 90, respectively, then your normalized scores would be 1.29, 1.12, 0.91. After replacing your lowest normalized score with the next highest, your normalized scores for the quizzes would become 1.29, 1.12, 1.12. For final grades, each of these normalized scores will be multiplied by the average score of each exam. With this system, there will be **no makeup exams**, except under extreme circumstances. Your final exam score cannot be replaced.

** For general course participation, such as asking or answering questions during lectures or discussions. At the discretion of the instructional staff.

Final exam	May 9, 2022	Mon 7:45-9:45am	location TBA

BYOL
Bring your own lunch. Take an opportunity to get to know your instructor, Prof. Yin, outside of class, and for him to get to know you. Coordinate with classmates when 2 or 3 (maximum) of you could lunch for 45min at the Discovery Building. Email Prof. Yin workable dates & times.

Approximate schedule of topics and (reading assignments) in BSLK.

Week of		TOPIC
		MOMENTUM TRANSPORT
JAN	24	Ch 0 Introduction (read BSLK 0.1 – 0.5)
		Ch 1 Viscosity and momentum transport (1.1 – 1.9)
	31	Ch 2 Shell momentum balances & laminar flow (2.1 – 2.8)
FEB	7	Ch 3 Equations of change for isothermal systems (3.1 – 3.3, 3.5 – 3.7, 3.9)
	14	Ch 4 Turbulent flow (4.1 – 4.4)
	21	Ch 5 Dimensional analysis in isothermal systems (5.1 – 5.6)
		Ch 6 Friction factors (6.1 – 6.3, 6.5) (**EXAM 1**, FEB 24, 7:30pm)
	28	Ch 7 Macroscopic balances for isothermal systems (7.1 – 7.6, 7.8)
		ENERGY TRANSPORT
MARCH	7	Ch 9 Thermal conductivity and energy transport (9.1 – 9.9)
		Ch 10 Shell energy balances & temperature distributions (10.1 – 10.11)
	14	***NO CLASS*** *(UW-Madison break)*
	21	Ch 11 Equations of change for non-isothermal systems (11.1 – 11.4, 11.6) (**EXAM 2**, MARCH 24, 7:30pm)
	28	Ch 13 Dimensional analysis in non-isothermal systems (13.1 –13.6)
		Ch 14 Heat transfer coefficients (14.1 – 14.4, 14.8)
APRIL	4	Ch 15 Macroscopic energy balances (15.1 – 15.5)
		Ch 16 Energy transport by radiation (16.1 – 16.4, 16.7)
		MASS TRANSPORT
	11	Ch. 17 Diffusivity and mass transport (17.1 – 17.6, 17.9)
		Ch. 18 Shell mass balances & concentration distributions (18.1 – 18.11)
	18	Ch 19 Equations of change for binary mixtures (19.1 – 19.4)
	25	Ch 21 Dimensional analysis for flowing mixtures (21.1 – 21.6) (**EXAM 3**, APRIL 28, 7:30pm)
May	2	Ch 22 Mass Transfer Coefficients (22.1 – 22.3)
		Ch 23 Macroscopic Balances for Multicomponent Systems (23.1 – 23.5)
		Review

ACADEMIC INTEGRITY
By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. **Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action.** This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to https://conduct.students.wisc.edu/academic-integrity/

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES
The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. **Students are expected to inform Prof. Yin of their need for instructional accommodations by the end of the first week of the semester,** or as soon as possible after a disability has been incurred or recognized. I will work either directly with the you or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. For more information, refer to
https://mcburney.wisc.edu/

DIVERSITY AND INCLUSION
Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world. For more information, refer to
https://diversity.wisc.edu/