

## **CBE 3324B – Mass Transfer Operations**

### **Course Outline - Winter 2026**

#### **Description**

This course reviews the fundamentals of interphase mass transfer and transfer units and then reviews the design of differential mass transfer equipment, with special emphasis on absorption, stripping, humidification and drying.

#### **Prerequisites**

CBE 2221A/B, CBE 2220A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

#### **Corequisites**

None.

#### **Antirequisites**

None.

#### **Contact Hours**

3 lecture hours and 1 tutorial hour, 0.5 course.

#### **Instructor**

Dr. Abdelkader Baayoun (SEB 3076) email: [abaayoun@uwo.ca](mailto:abaayoun@uwo.ca)

Office hours: by appointment.

#### **Class Attendance Policy**

Class attendance is mandatory and will be monitored. The instructor reserves the right to request debarring from the final examination to those students that miss more than 50% of the lectures + tutorials in the term.

#### **Required Text**

None

#### **Reference Texts**

Treybal, R. E., Mass-Transfer Operations, McGraw-Hill, 1981

Geankolis, C. J., Transport Processes and Unit Operations, Prentice Hall, New Jersey, USA, 1993.

## **Course Notes**

Course notes will be posted on the course website to support learning. However, they do not replace lecture attendance. The instructor may present additional explanations/clarification, examples, and insights during lectures and tutorials that are not explicitly written in the notes. Therefore, students are expected to attend lectures and take their own notes.

## **Units**

SI units will be the primary units used in lectures and examinations.

## **General Learning Objectives**

The general objectives are for the student to be able to:

- Understand the fundamentals of interphase mass transfer.
- Understand the concept of transfer units.
- Apply theoretical and empirical concepts for the design of interphase mass transfer operations.
- Perform the preliminary design of binary and multicomponent absorption and stripping equipment.
- Perform the preliminary design of humidification and drying equipment.

## **Specific Learning Objectives**

### **Mass Transfer Fundamentals**

At the end of this topic, students should be able to:

- Solve fundamental problems in steady-state and unsteady state diffusion.
- Understand Fick's law and be able to determine when it is valid.

### **Mass Transfer Coefficient**

At the end of this topic, students should be able to:

- Evaluate individual mass transfer coefficients using empirical correlations, models or analogies.

### **Transfer Units**

At the end of this topic, students should be able to:

- Understand the concept of transfer units.
- Solve differential countercurrent mass transfer problems using transfer units.

### **Absorption and Stripping Towers**

At the end of this topic, students should be able to:

- Determine when packed towers are more suitable than trayed towers.
- Evaluate the required liquid-to-gas or gas-to-liquid ratio.
- Select the most appropriate packing type and size.
- Select the most appropriate tower diameter.
- Estimate the required packing height.
- Evaluate the tower pressure drop.

### **Humidification**

At the end of this topic, students should be able to:

- Perform basic humidification calculations.

- Design humidification and cooling towers.

### **Drying**

At the end of this topic, students should be able to:

- Select the most appropriate equipment for a specific drying problem.
- Perform the preliminary design of a dryer.

### **Graduate Attribute Assessment for Accreditation by the Canadian Engineering Accreditation Board**

<b>Graduate Attribute</b>	<b>Indicator</b>	<b>Assessment tool</b>	<b>Assessment Level</b>
Knowledge Base	KB1 – Demonstrate competence in Mathematics	Final Exam	D: Developed
Problem Analysis	PA3 – Demonstrate ability to reach substantiated conclusions	Final Exam	D: Developed

### **Evaluation**

The final course mark will be determined as follows:

Assignments (3 in total)	20 %
One Mid-term Examination	30 %
Final Examination	50 %

**There will be no make-up midterm test.** If you miss the midterm test with a validated absence (i.e. through the UGS office/Student Absence Portal), then the weight of the midterm will be shifted to the Final Exam. Students missing the midterm without a validated absence will receive a grade of zero.

The final examination will be three hours in duration and will be scheduled by the Registrar during the April examination period. **Students must pass the final examination to pass this course.** Students who fail the final examination will be assigned 48% if the aggregate mark is higher than 50%, or the aggregate mark.

### **Repeating All Components of the Course**

In accordance with Senate and Faculty Policy, students who have failed an Engineering course (i.e. <50%) must repeat all components of the course. **No special permissions will be granted enabling a student to retain assessment marks from previous years.**

### **Use of English**

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

### **Attendance**

**Attendance** to lectures and tutorial sessions **is mandatory and will be monitored**. Any student who, in the opinion of the instructor, is absent too frequently from class or tutorial periods will will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the final exam in the course.

### **Cheating**

University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning (see Scholastic Offence Policy in the Western Academic Calendar).

### **Plagiarism**

Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar). The University of Western Ontario has software for plagiarism checking. In the case of assignments, students may be required to submit their work in electronic form for plagiarism checking.

### **Sickness and Other Problems**

Students should immediately consult with the instructor or Associate Chair (Undergraduate) if they have problems that could affect their performance in the course. The student should seek advice from the Instructor or Associate Chair (Undergraduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Undergraduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

### **Communication**

Students are responsible for regularly checking their Western email and notices posted on the Brightspace course site.

### **Email policy**

Students wishing to communicate with the instructor by email should write "CBE3324B-question" on the subject line. Students should allow a minimum of 2 business days to get a reply. The course instructor and teaching assistants do not monitor email outside business hours.

## **Policy Framework: Missed Classes, Late Work, and Academic Integrity**

### **Absence/Late Accommodation Policy**

1. Students must familiarize themselves with the University Policy on Academic Consideration

Undergraduate Students in First Entry Programs posted on the Academic Calendar:  
[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/academic\\_consideration\\_Sep24.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf)

This policy does not apply to requests for Academic Consideration submitted for attempted or completed work, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult [Accessible Education](#).

2. Students missing a test/assignment/lab or examination will report the absence by submitting Academic Consideration Request form through [STUDENT ABSENCE PORTAL](#).
3. **All requests for Academic Considerations must be made within 48 hours after the assessment date or submission deadline. All Academic Consideration requests must include supporting documentation. However, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request without supporting documentation in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:**
  - **Examinations scheduled during official examination periods.**
  - **Midterm Tests and other designated assessments as noted on the course outline.**
  - **Any assessment already covered by a flexible deadline.**
  - **If a student mistakenly submits their one allowed Academic Consideration request without supporting documentation for the assessments listed above that do not require academic consideration, the request cannot be recalled and reapplied. This privilege is forfeited.**
4. **Requests without supporting documentation are limited to one per term per course.**
5. **An undocumented absence is only valid for a 24-hour period, from midnight on the day specified to midnight of the following day.** An appropriate use of an undocumented absence would be for an in-class assessment that takes place that day. Where the time given to complete the assessment is longer than 24 hours, an undocumented absence will not cover a student for the full time given to complete the assessment, and flexibility considerations in submitting the assessment will override the undocumented absence.
7. **NOTE: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.**
8. **It is the student's responsibility to check the date, time and location of the [Special Examination](#).**

## **II. Religious Accommodation**

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

## **III. Academic Integrity**

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit [Academic Integrity Western Engineering](#) for more information

## **IV. Academic Offences**

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.

[Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know](#)

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

## **V. Faculty of Engineering AI Policy**

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. You are able to use GenAI tools as follows:

- For any written assignment, except take-home exams and personal reflections, you may use a GenAI tool to help you brainstorm or frame your initial ideas and grammar. However, your final submission must be entirely in your own words and demonstrate your individual experience and insight.
- For any written or practical project AI tools may be used across your workflow. Use them responsibly and reflect in your final presentation on how these tools supported or challenged your creative thinking.
- All GenAI tools used at any point of the course with the intent of helping with homework, assignments or any other assessment content must be disclosed and referenced appropriately.

**GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use.** If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

## VI. Accessibility

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the [Accessibility Western University](#) for information on accessibility-related resources available at Western. Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit [Academic Support & Engagement -Academic Accommodation](#).

## VII. Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the [Office of Equity, Diversity and Inclusion](#).

## VIII. Health and Well-Being

- [Health & Wellness Services – Students](#) - Offers appointment-based medical clinic for all registered part-time and full-time students.
- [Mental Health Support](#) - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.

- [Crisis Support](#) - For immediate assistance, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click [here](#).
- [Gender-Based Violence and Survivor Support](#) - "Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at the following website: [https://www.uwo.ca/health/student\\_support/survivor\\_support/gethelp.html](https://www.uwo.ca/health/student_support/survivor_support/gethelp.html) To connect with a case manager or set up an appointment, please contact support@uwo.ca.

### **Important Contacts**

<a href="#"><u>Engineering Undergraduate Services</u></a>	SEB 2097	519-661-2130	engugrad@uwo.ca
<a href="#"><u>Office of the Registrar/Student Central</u></a>	WSSB 1120	519-661-2100	

### **Important Links**

- [WESTERN ACADEMIC CALENDAR](#)
- [ACADEMIC RIGHTS AND RESPONSIBILITIES](#)
- [ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS](#)
- [UNIVERSITY STUDENTS' COUNCIL \(USC\) - SERVICES](#)
- [IMPORTANT DATES AND DEADLINES](#)
- [ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS](#)
- [ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS](#)
- [SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS](#)
- [STUDENT FORMS](#)
- [OFFICE OF THE REGISTRAR](#)
- [RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES \(SYLLABI\)](#)
- [ACADEMIC APPEALS](#)
- [STUDENT ABSENCE PORTAL](#)