Faculty of Engineering

GPE 3395Y – GREEN ENGINEERING LABORATORY
COURSE OUTLINE 2017-2018

Description
Through this laboratory course, students perform both pre-designed and investigation lab experiments using the principles and knowledge from Heat Transfer (CBE 3322), Staged Operations (CBE3323) and Mass Transfer (CBE 3324) courses, aiming to integrate and apply selected concepts/theories to green process engineering applications.

Prerequisites
CBE 2220A/B, CBE 2221A/B, CBE 2291A/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
CBE 3322A/B, CBE 3323A/B, CBE 3324A/B

Antirequisites
CBE 3395Y

Contact Hours
3 laboratory hours per week for 2 semesters (Fall and Winter), 0.5 course.

Instructors
Dr. Charles Xu (CMLP 2335), 519-661-2121 x 86414, email: cxu6@uwo.ca

Laboratory Technicians
Souheil Afara (SEB 1081C) 519-661-2111 ext 88457 email: safara@uwo.ca

Undergraduate Assistant
Joseph Cole Handsaeme (TEB 477) Telephone: 519-661-2131 ext 82131 email: cbeundergraduate@uwo.ca

Required Text
GPE 3395 course notes and labs manuals, authored by Dr. Xu, are available for students to download from GPE 3395Y course website on OWL: https://owl.uwo.ca/portal (login required).
Reference Texts
Course Notes from CBE 3322A/B, CBE3323 A/B, 3324A/B.

Laboratories and Project
Rooms for laboratories: SEB 1079, SEB 1081

The laboratory course applies and integrates the concepts reviewed in heat and mass transfer operations, and staged operations courses. Training of team work and leadership is one of the key objectives of this course, the labs/projects are all group labs/projects involving 3-6 students per group depending on the size of the class. Students’ performance will be judged according to the following criteria:

- Time and efforts
- Judgment
- Individual and team work
- Quality and amount of the data from the experimental labs
- Ability of investigation and making proposal for specific research projects
- Quality of the analysis/discussion of the results, relating the results with the concepts reviewed in the relevant courses.

In Session A (Fall term) and Session B (Winter term), students in groups will carry out one of the following 8 group labs including 6 regular labs and 2 investigation labs, supervised by lab technicians, the TAs and the instructor. For the 6 regular labs, students perform the labs as per the manuals provided, and each regular lab can be completed within 6-9 h (2-3 weeks/regular lab). For the 2 investigation labs, detailed lab manuals are not provided (except for some description of the investigation projects and objectives), and the student groups need to submit their proposal for the instructor to review and approval prior to their experiments. Each investigation lab shall be completed within 9-12 h (3-4 weeks/investigation lab).

Session A (Fall term):
- Lab 1: Double-pipe heat exchangers (2 weeks)
- Lab 2: Convective heat transfer enhancement in a stirred tank reactor without and with solid particles (2 weeks)
- Lab 3: A green power lab with solar cells and hydrogen fuel cells (2 weeks)
- Lab 4 (Investigation lab): Liquid phase mass transfer enhancement in a stirred tank reactor - Absorption of CO\textsubscript{2} using NaOH solution: effects of agitation, initial CO\textsubscript{2} pressure or temperature (4 weeks in total including one week for the instructor or TAs to demonstrate the use of the equipment)

Session B (Winter term):
- Lab 5: Separation of chemicals by liquid-liquid extraction (2 weeks)
- Lab 6: Distillation of Binary Liquid Mixtures (Ethanol Distillation) (2 weeks)
- Lab 7: Effects of mass transfer on synthesis of nanoparticles of magnesium oxide (MgO), measurement of particle size distribution and average (mean) particle size (2 weeks)
• **Lab 8 (Investigation lab):** Heat transfer in a gas-solid fluidized bed: effects of superficial gas velocity, particle size and initial bed height (4 weeks in total including one week for the instructor or TAs to demonstrate the use of the equipment to determine minimum fluidization velocity ($U_{mf}$))

**Notes:**

1. For Investigation labs: The students group must submit a proposal for approval by the instructor before starting the lab.
2. Although all labs are carried out in groups, **individual report by each student** must be submitted, which will be graded separately. Plagiarism will be checked, so students must write their reports in their own words and prepare their own Tables/Figures.
3. Each lab report must be within single-line space 15 pages, single spaced, including all contents as required and raw data as appendix. Exceeding the page limit will result in mark deduction by 5%/page.

**Units**

SI units will be used in lectures and examinations.

**General Learning Objectives**

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**Learning Objectives**

Generally, through this course students are able to perform pre-designed lab experiments using the principles and knowledge from the following courses, aiming to integrate and apply selected concepts/theories to green process engineering applications:

- Heat transfer operations (CBE 3322)
- Mass transfer operations (CBE 3324)
- Staged Operations (CBE 3323)

Specifically, students should be able to:

- Perform pre-designed lab experiments following the lab manuals provided;
- Propose and design their own experimental procedure and methods, and perform the experiments and collect data, supervised by the TAs and the instructor.
- Interpret the experimental results using the principles and knowledge from the relevant courses.
- Present their results and conclusions in oral presentations and written reports.

**Evaluation**

The final course mark will be determined as follows:

- **Proposals (investigation labs)**: 20%
- **Lab reports**: 40%
• Presentations and oral exams (at the end of Sessions A and B, respectively) 40%

Notes
• Students must secure a passing mark (>50%) in the oral exams to pass this course.
• A printed copy of the lab report must be submitted to the specified locker within 2 weeks after completion of each lab. 10% mark PER DAY OF LATE deduction will apply for a late submission.
• Group presentation and oral exam (3-5 questions for each student) will be held on specific topics in last week of each term.

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 laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

Use of English
In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, 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 in laboratories is mandatory. Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, 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 regular examination 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
Students must write their essays/reports 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. 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. Students may be required to submit their work in electronic form for plagiarism checking.

**Conduct**
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.

**Sickness and Other Problems**
Students should immediately consult with the instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented. The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

**Notice**
Students are responsible for regularly checking their Western email and notices posted through OWL.

**Consultation**
Students are encouraged to discuss problems with their teaching assistant and/or instructor in tutorial sessions. Office hours will be arranged for the students to see the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the appropriate instructor.

**Accreditation (AU) Breakdown**
- Engineering Science = 50%
- Engineering Design = 50%

September 2017/cxu
INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

IF, ON MEDICAL OR COMPASSIONATE GROUNDS, YOU ARE UNABLE TO WRITE TERM TESTS OR FINAL EXAMINATIONS OR COMPLETE COURSE WORK BY THE DUE DATE, YOU SHOULD FOLLOW THE INSTRUCTIONS LISTED BELOW. YOU SHOULD UNDERSTAND THAT ACADEMIC RELIEF WILL NOT BE GRANTED AUTOMATICALLY ON REQUEST. YOU MUST DEMONSTRATE TO YOUR DEPARTMENT (OR THE UNDERGRADUATE SERVICES OFFICE) THAT THERE ARE COMPELLING MEDICAL OR COMPASSIONATE GROUNDS THAT CAN BE DOCUMENTED BEFORE ACADEMIC RELIEF WILL BE CONSIDERED. DIFFERENT REGULATIONS APPLY TO TERM TESTS, FINAL EXAMINATIONS AND LATE ASSIGNMENTS. PLEASE READ THE INSTRUCTIONS CAREFULLY. (SEE THE 2017 UWO ACADEMIC CALENDAR).

A. GENERAL REGULATIONS & PROCEDURES

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.

2. If you are an upper year student and you are missing a test/assignment/lab or exam that is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097. Otherwise, you will report to your department office to request relief.

3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.

4. Documentation must be provided as soon as possible. If no one is available in your Department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.

5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM TESTS

1. If you are in first year and you are unable to write a term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.

2. If you are an upper year student and you are unable to write a term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief. Otherwise, you will report to your department office to request relief.

3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).

4. Discuss with the instructor if and when the test can be rescheduled. N.B. The approval of the Chair or the Undergraduate Services Office is required when rescheduling term tests.

C. FINAL EXAMINATIONS

1. If you are unable to write a final examination, contact the Undergraduate Services Office PRIOR TO THE SCHEDULED EXAMINATION TIME to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.

2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, sleeping in, misreading timetable and travel arrangements.

3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department and the Associate Dean and in order to apply you must sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

N.B. It is the student's responsibility to check the date, time and location of the Special Examination.

D. LATE ASSIGNMENTS

1. Advise the instructor if you are having problems completing the assignment on time (prior to the due date of the assignment).

2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).

3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Associate Dean if you are in first year) is not required if assignments will be completed prior to the last day of classes.

4. i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean. Documentation is mandatory.

   ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean.
E. **SHORT ABSENCES**

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. **EXTENDED ABSENCES**

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You may want to seek advice from the academic counsellor in your Department or Ms. Karen Murray in the Undergraduate Services Office, if you are in first year.

G. **DOCUMENTATION**

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, you must provide the doctor with a Student Medical Certificate to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor’s notes will not be accepted; only the Student Medical Certificate will be accepted.

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

H. **ACADEMIC CONCERNS**

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).

2. You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.

3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your academic counsellor.

**Calendar References:** Check these regulations in your 2017 Western Academic Calendar available at [www.westerncalendar.uwo.ca](http://www.westerncalendar.uwo.ca).

Absences Due to Illness: [http://westerncalendar.uwo.ca/2017/pg117.html](http://westerncalendar.uwo.ca/2017/pg117.html)

Academic Accommodations for Students with Disabilities: [http://westerncalendar.uwo.ca/2017/pg118.html](http://westerncalendar.uwo.ca/2017/pg118.html)


Course Withdrawals: [http://westerncalendar.uwo.ca/2017/pg119.html](http://westerncalendar.uwo.ca/2017/pg119.html)

Examinations: [http://westerncalendar.uwo.ca/2017/pg129.html](http://westerncalendar.uwo.ca/2017/pg129.html)

Scheduling of Term Assignments: [http://westerncalendar.uwo.ca/2017/pg135.html](http://westerncalendar.uwo.ca/2017/pg135.html)

Scholastic Offences: [http://westerncalendar.uwo.ca/2017/pg111.html](http://westerncalendar.uwo.ca/2017/pg111.html)

Student Medical Certificate: [http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)


Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

**Drop Deadlines:**

- First term half course (i.e. “A” or “F”): November 5, 2017
- Full courses and full-year half courses (i.e. “E”, “Y” or no suffix): November 30, 2017
- Second term half or second term full course (i.e. “B” or “G”): March 7, 2017

**Contact Information:**

- Undergraduate Services Office: SEB 2097 Telephone: (519) 661-2130 E-mail: engugrad@uwo.ca
- Dept. of Chemical and Biochemical Engineering & Green Process Engineering: TEB 477 Telephone: (519) 661-2131 E-mail: cbegrad@uwo.ca
- Dept. of Civil and Environmental Engineering: SEB 3005 Telephone: (519) 661-2139 E-mail: civil@uwo.ca
- Dept. of Electrical and Computer Engineering, Software Engineering & Mechatronics Engineering: TEB 279 Telephone: (519) 661-3758 E-mail: cceugrad@uwo.ca
- Dept. of Mechanical and Materials Engineering: SEB 3002 Telephone: (519) 661-4122 E-mail: mmeundergraduate@uwo.ca

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