The University of Western Ontario  
Faculty of Engineering

DEPARTMENT OF CHEMICAL & BIOCHEMICAL ENGINEERING

CBE/GPE 4497 - Chemical Process and Plant Design  
Course Outline 2016-2017

Description
A design is prepared for a full-scale chemical process. This involves the design of standard equipment such as pumps, heat exchangers, compressors, etc., detailed design of major pieces of equipment, an estimate of the requirements for new materials and energy, and a calculation of total costs and detailed economical analysis. Problem formulation, alternative design solutions and professional decision making are emphasized. Regulations, standards and codes related to design tasks will be reviewed, bringing the students closer to real world engineering.

Prerequisites
CBE 3325A/B, CBE 3317Y or the former CBE 3397, CBE 3323A/B, CBE 2220A/B, CBE 2224A/B, CBE 3315A/B, CBE 3322A/B.

Corequisites
Business Administration 2299 or registration in Option C of the Chemical Engineering program.

Antirequisites
CEE 4441, ECE 4416, MME 4499, SE 4450, ES 4499.

Contact Hours
1 hours lecture, 7 tutorial and workshop hours, 1.0 full course.

Instructors
Dr. S. Barghi. (TEB 447) sbarghi2@eng.uwo.ca  
Dr. Dominic Pjontek, (CMLP 2337) dpjontek@uwo.ca

Industry consultant
Dr. Raj Barchha

Undergraduate Assistant
Brandy Hunter (TEB 477) Telephone: 519-661-2111 ext: 82131 brandy.hunter@uwo.ca

Recommended Text
**Reference Texts**


Reference to other books and articles will be made at the appropriate time during the course.

**Course Notes**

Course notes will be available for download from the course website.

**Units**

SI units will be generally used in lectures and examinations.

**General Learning Objectives**

<table>
<thead>
<tr>
<th>Knowledge Base</th>
<th>Individual Work</th>
<th>X</th>
<th>Ethics and Equity</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Analysis</td>
<td>X</td>
<td>Team Work</td>
<td>X</td>
<td>Economics and Project Management</td>
</tr>
<tr>
<td>Investigation</td>
<td>X</td>
<td>Communication</td>
<td>X</td>
<td>Life-Long Learning</td>
</tr>
<tr>
<td>Design</td>
<td>X</td>
<td>Professionalism</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Engineering Tools</td>
<td>X</td>
<td>Impact on Society</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Objectives**

Based on case study format, this course introduces students to chemical process synthesis and analysis and equipment sizing through creative problem solving and teamwork while applying basic principles in chemical engineering and economics learned in other courses in the curriculum. The general objectives are for the student to become able to:

- apply engineering and professional judgement to propose solutions to open-ended design problems.
- formulate problems and apply decision making to evaluate design alternatives.
• identify safety, environmental, social, legal and economic issues, and their impact on design decisions.
• develop strong technical communication skills in order to present and defend technical information and design decisions in both written and oral format and recognize the need for continual (life-long) learning to keep abreast of new developments and information that could affect decisions related to design, modifications and improvements in chemical processes.

These objectives are accomplished within the framework of a workshop, simulating to the extent possible, and the real world industrial environment. During the workshops, groups of up to six students are given guidance and coaching (interactive learning) to assist in moving forward the design project. Each group of project engineers is assigned to a specific section head (Teaching Assistant).

**Specific Learning Objectives**
The course is organized to develop following professional and job related skills of students while they apply acquired knowledge of engineering concepts and principles to an independent study industrial design project.

**Team Work and Time Management**
Students should be able to:
• work in a team as they become more familiar with dynamics of team work and learn to make use of strengths of team members.
• divide a project into tasks and sub-tasks with deadlines and milestones to allow scheduling and resource allocation and utilization.

**Information Collection, Analysis and Synthesis**
Students should be able to:
• collect required information from different sources including literature, industry, equipment suppliers, internet, specialists etc.
• analyse sometimes conflicting information and learn to deal with it.

**Critical Thinking (applied to design process)**
Students should be able to:
• recognize existence of alternative solutions for the same problem.
• compare alternatives based on selected criteria.
• ensure check calculations and consultations before making a recommendation.

**Engineering Judgment**
Students should be able to:
• apply approximations in design calculations based on sound reasoning and documentation.
• apply practical considerations to reduce downtime, improve safety and operability of a system being designed.
Engineering Safety
Students should be able to:
• incorporate engineering safety in their final design and modify the design accordingly
• perform HAZOP study for the designed units
• perform Layers of protection analysis (LOPA) for their design
• do risk assessment for the process
• perform environmental protection analysis addressing safety issues
• perform safety and risk analysis

Communication
Students should be able to:
• present their work both orally and in written format as per acceptable standards.

Progress will depend on a number of factors including complexity of the selected process, availability of process information, industrial contacts established by group, etc. Initiative and creativity is required from every student. This course draws on knowledge, skills and techniques learned in prerequisite and corequisite courses to solve practical engineering problems. It is a finishing course: students need to demonstrate sound design and professional capabilities before they can graduate.

Evaluation
Project Definition and Scope 5%
Detailed Flow Plan with Description (grp. mark) 10%
Short-cut Equipment Design 15%
First Oral Presentation (50% ind. mark, 50% grp.) 10%
Final Oral Presentation (60% ind. mark, 40% grp.) 12%
First Design Report (50% ind. mark, 50% grp.) 15%
Final Design Report (60% ind. mark, 40% grp.) 30%
Individual performance* 3%

*Attendance in the meetings, workshop, on time delivery of assigned tasks, etc (based on the TAs’ comments).

Note
Students must secure a passing mark (>50%) in both the final oral presentation and final design report to pass this course.

1. Design Reports
A design report is due from each group at the end of each term culminating the efforts of the group. The reports will be submitted to the Undergraduate Assistant in TEB 477. Format for design report is given in the course guide book in WebCT/OWL.

First Formal Report due: To be announced
Final Formal Report due: To be announced

The penalty for late submission of the deliverables is 5% per day.

2. Oral Presentations
Two oral presentations will be made by each design group, one in each term. Each student will take part in the presentations. Presentation schedule will be distributed in class about two weeks before presentation week.

First Formal Oral Presentation: To be announced
Final Formal Oral Presentation: To be announced
Note: If a member of a group is not present in the presentations, the allocated time will be reduced.

3. Detailed Flow Plan with Description
Each design team will hand in a detailed flow plan of the process drawn on a 60cmX90cm sheet together with a description of the process to its section Teaching Assistant by the due date (to be determined).

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 penalised 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.

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 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).
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.

**Attendance**

**Attendance at all lectures, tutorials and laboratories is mandatory.** Any student who, in the opinion of the instructor, is absent too frequently from class, or workshop/tutorial periods 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 making final oral presentation and submission of final design report.

**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.

**Notices**

Students are responsible for regularly checking their Western email and notices posted in front of chief instructor’s offices.

**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**

Complimentary Studies = 25%
Engineering Design = 75%
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 accommodation will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services office if you are in first year) that there are compelling medical or compassionate grounds that can be documented before academic accommodation will be considered. Different regulations apply to term tests, final examinations and late assignments. Read the instructions carefully. (see the 2016 Western Academic Calendar).

A. GENERAL REGULATIONS & PROCEDURES

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

2. Bring your request for academic accommodation to the attention of the Chair of the department (or the Undergraduate Services office if you are in first year) prior to the scheduled time of the test or final examination or due date of the assignment. If you are unable to contact the relevant person, leave a message with the appropriate department (or Undergraduate Services office, if you are in first year). The addresses, telephone and fax numbers are given at the end of these instructions. Documentation must be provided as soon as possible.

3. 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 exam reweighted on a retroactive basis is not permitted.

B. TERM TESTS

1. If you are unable to write a term test, inform your instructor and the Chair of your Department (or the Undergraduate Services Office if you are in first year) prior to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office and inform the Chair of the Department (or the Undergraduate Services Office if you are in first year).

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

3. Discuss with the instructor if and when the test can be rescheduled. N.B. The approval of the Chair (or the Undergraduate Services Office if you are in first year) 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 (please spell your full name).

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.
SHORT ABSENCES

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

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 the counsellors in the Undergraduate Services Office if you are in first year.

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 if you are in first year). This note must contain the following information: severity of illness, effect on academic studies and duration of absence.

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).

ACADEMIC CONCERNS

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).

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.

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 2016 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Absences Due to Illness - page 117
Academic Accommodations for Students with Disabilities - page 118
Academic Accommodations for Religious Holidays - page 119
Incomplete Standing - page 104
Scheduling of Term Assignments – page 97
Scholastic Offences - page 113
Special Examinations - page 132

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, 2016
Full courses and full-year half courses (i.e. “E”, “Y” or no suffix): November 30, 2016
Second term half or second term full course (i.e. “B” or “G”): March 7, 2017

Undergraduate Services Office: SEB 2097 telephone: (519) 661-2130 fax: (519) 661-3757
Dept. of Chemical and Biochemical Engineering: TEB 477 telephone: (519) 661-2131 fax: (519) 661-3498
Dept. of Civil and Environmental Engineering: SEB 3005 telephone: (519) 661-2139 fax: (519) 661-3779
Dept. of Electrical and Computer Engineering, Software Engineering
Mechatronics Engineering TEB 279 telephone: (519) 661-3758 fax: (519) 850-2436
Dept. of Mechanical and Materials Engineering: SEB 3002 telephone: (519) 661-4122 fax: (519) 661-3020

Revised 29-Sep-16