ENGG*2560 Environmental Engineering Systems
Winter 2018

School of Engineering

1 INSTRUCTIONAL SUPPORT

1.0 Course Instructor

Instructor: Erica Pensini, Assistant Professor
Office: Richards 2560
Email: epensini@uoguelph.ca
Office hours: By appointment

1.1 Hands-On Lab Instructors

Joanne Ryks	Ryan Smith
THRN1114	THRN1114
JRyks@uoguelph.ca	RSmyth17@uoguelph.ca

1.2 Teaching Assistants (Tutorial Instructors)

GTA	Email	Office Hours
Sarah DeDecker	sdedecke@uoguelph.ca	NONE … use labs well
Arvind Iyer	arvind@uoguelph.ca	NONE … use labs well

2 LEARNING RESOURCES

2.0 Course Contact Hours (Lectures, Labs, & Tutorials)

The lectures, labs and tutorials are the primary means used to support your learning in this course. Lectures will be the primary means for course news and announcements in addition to provision of course materials. Lecture attendance is expected. Tutorials will be the primary means for the instructional team to coach you. Tutorial attendance is required. Labs will be the primary means for some hands-on experience. Lab attendance is required.

2.1 Course Website

ENGG*2560 Courselink site will provide copies of lecture slides, project descriptions, assignments and relevant announcements. You are expected to read all announcements posted on Courselink.

2.2 Required Resources

1. None

2.3 Recommended Resources

Online books available through the library's website:

- Euzen, Jean-Paul; Trambouze, Pierre. Chemical Reactors - From Design to Operation. Electronic ISBN 978-1-68015-336-1.
- Luyben, William L. Chemical Reactor Design and Control. Electronic ISBN 978-1-61583-270-5
- Louis Theodore. Chemical Reactor Analysis and Applications for the Practicing Engineer. Online ISBN: 9781118158630
- Coker, A. Kayode. Modeling of Chemical Kinetics and Reactor Design. Electronic ISBN 978-0-08-049190-5.
- Levenspiel, Octave. Chemical Reaction Engineering. Electronic ISBN 978-1-60119-921-8.
- Schmidt, Lanny D. Engineering of Chemical Reactions. Electronic ISBN 978-1-61344-112-1.
- Walas, S.M. Chemical Process Equipment - Selection and Design. Electronic ISBN 978-0-0805-2344-6.

Courselink will provide additional resources.

2.4 Additional Resources

Lecture Information: All the lecture slides will be posted on the Courselink site.

Lab Information: Posted on Courselink.

Assignments: Posted on Courselink.

Practice examples: Posted on Courselink.

Miscellaneous Information: See Courselink.

2.5 Communication & Email Policy

Communication associated with course material is delivered by a combination of the lectures, lab/tutorials, and the Courselink site. It is your responsibility to receive communication from ALL of these sources. There will be some mutual reinforcement between these sources, but they are not completely redundant sources. As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: **e-mail is the official route of communication between the University and its students**.

Emails sent to the instructor or the teaching assistants must be written in a professional manner, and must contain a relevant subject line. Emails written in a sloppy manner or without an appropriate subject line will not be answered. Appropriate ways to address any of your instructors include using the instructor's first name or job title (e.g. professor or doctor). Emails in which any of your instructors is addressed as "Miss" will not be answered.

3 ASSESSMENT

3.0 Dates and Distribution

FINAL EXAM	35%	April 13, 2:30-4:30 pm
MIDTERM	15%	February 26, 4:30 – 5:20 pm, THRN, Room 1307
LABS (*Read important note below)	10% 25% 10%	Batch Reactor Lab – Due February 13th, 6:00 pm Reactor Systems Lab – Due March 13th, 6:00 pm Noise Lab – Due April 3rd, 6:00 pm
TUTORIALS (**Read important note below)	5%	The students will work on selected problems during the tutorials, either individually or in pairs. Only active participants will be awarded 5%.

* Lab work will be conducted in groups selected by the students. **A peer evaluation will be conducted to verify the active contribution of all team members**. **A negative peer evaluation will result in loss of marks (i.e. in an individual mark lower than the mark assigned to the team)**, unless a clear evidence of relevant individual contributions is provided. Students are encouraged to contact the instructor early should any conflicts arise within the team.

** In this context, **an active participant is a student who works on the assigned problems during the tutorials**. Problem solving either before or after the tutorials will not be considered as active participation to the tutorials. Solved problem sets handed in either before or after the tutorials will not be accepted.

NOTE: There will be no makeup labs, midterm or tutorials. The weight of the final exam will be increased in case a student will miss a lab, a midterm or a tutorial due to a valid cause. If a student will miss a lab, a midterm or a tutorial without a valid cause no adjustments in the weight of the final exam will be made, and the student will receive a grade of zero on the missed lab, midterm or tutorial.

3.1 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to a valid cause (medical, psychological, or compassionate reasons), please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor **within two weeks of the start** of the semester to make alternate arrangements. Late requests will be disregarded. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: To pass the course students must obtain a grade of 50% or higher.

Missed test: If you miss the midterm, a lab or a tutorial due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam.

Lab Work: You must pass the laboratory safety quiz to be permitted to complete the hands on laboratories. You must attend and complete the hands on laboratory in order to be eligible to complete the required written laboratory report.

Late Lab Reports: Late submissions (without instructor permission based on suitable grounds and documentation) will be penalized. The penalty will depend on how late: 10% for 1-12 hours; 25% for 12-48 hours; 50% for 48-96 hours and 100% after 96 hours.

Teamwork: Teamwork is required for the completion of the three labs in the course. It is expected that you are an active member of the team and provide an approximately **equal contribution** to the submitted work. **If it becomes apparent that this is not the case, the instructor will assign an individual grade substantially lower grade than the team grade**.

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4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.0 Calendar Description

Analysis techniques for natural and engineered systems including chemical, physical and biological processes. Mass balance analysis for steady state and unsteady state situations. Analysis under both equilibrium and non-equilibrium conditions. Reactor types including batch, plug-flow, CSTR. Noise pollution, control and prevention.

Prerequisite(s): CHEM*1050, MATH*2270

4.1 Course Aims

This course aims to establish fundamental chemical engineering skills necessary to address environmental engineering systems. The course also aims to introduce basic noise modelling and control approaches.

4.2 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. **Apply (3)** chemical mass balances to a range of environmental engineering components.
2. **Develop (5)** mathematical models of a range of environmental engineering systems.
3. **Develop (5)** computer models of environmental engineering systems.
4. **Explain (2)** basic noise control approaches.
5. **Apply (3)** basic noise modelling equations.
6. **Develop (5)** computer models of noise equations.
7. **Demonstrate (3)** safe laboratory practices based on guidance provided.
8. **Produce (4)** experimental results in an interpretable form (effective tables and figures).
9. **Discriminate (4)** between good and not-so-good experimental results and between model and experiment.
10. **Formulate (5)** a credible set of conclusions and recommendations based on experimental objectives.
11. **Prepare (3)** a well-structured laboratory report.

4.3 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1, 2, 4, 5	Tests, Exams, Labs
2. Problem Analysis	1, 2, 4, 5	Tests, Exams, Labs
3. Investigation	7, 8, 9, 10, 11	Labs
4. Design	-	
5. Use of Engineering Tools	3, 6, 7	Labs
6. Communication	11	Labs
7. Individual and Teamwork	-	Labs
8. Professionalism	-	
9. Impact of Engineering on Society and the Environment	1-10	Tests, Exams, Labs
10. Ethics and Equity	-	
11. Business & Project Management	-	
12. Life-Long Learning	3, 6	Labs

4.4 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink, but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.5 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.6 Relationships with other Courses & Labs

Previous Courses:

CHEM*1040/1050: Chemicals are generally pollutants. Chemical properties are key to pollutant impacts and pollutant treatment and prevention and resource recovery.

CIS*1500: Programming logic.

ENGG*1500: Manipulating variables and equations is an essential skill.

MATH*2270: Simple differential equations are used throughout the course.

Follow-on Required Courses:

ENGG*3180: Air Quality (required for EE's only). Chemical behaviour in the atmosphere relies on ENGG*2560, Fluid Mechanics and Thermodynamics.

ENGG*3590: Water Quality. Chemical behaviour in water relies on ENGG*2560.

ENGG*3470: Mass transfer operations (required for EE's only). An extension of the principles of ENGG*2560 to systems with mass transfer limitations between phases (i.e. non-equilibrium).

ENGG*4340: Solid & Hazardous Waste Management (required for EE's only).

Follow-on Elective Courses:

ENGG*4070: Life Cycle Assessment for Sustainable Design

ENGG*4240: Site Remediation

ENGG*4760: Biological Wastewater Treatment Design

ENGG*4770: Physical & Chemical Wastewater Treatment Design

ENGG*4810: Control of Atmospheric Particulates

ENGG*4820: Atmospheric Emission Control – Combustion Systems

5 TEACHING AND LEARNING ACTIVITIES

5.0 Timetable

Lectures:			
M, W, F		4:30 – 5:20 p.m.	THRN, 1307
Tutorials & Labs			
Friday	Sec 02	12:30 – 14:20	THRN 1116/ THRN 2336/ MACN 202
Wednesday	Sec 03	9:30 – 11:20	ALEX 309/ THRN 1116/ THRN 2336
Wednesday	Sec 04	11:30 – 13:20	THRN 1116/ THRN 2336/ MCKN 315

* You may only attend an alternate tutorial or lab time with prior permission of the instructor

5.1 Lecture Schedule

Lectures (Approx)	**Lecture Topics**	**Learning Objectives**
1	Introduction	ALL
2-5	Mass & Energy Balance Principles	1, 2
6-18	Reactors & Chemical Kinetics	1, 2
19-21	Biochemical Kinetics & Reactors	1, 2
22-27	Noise	4, 5
28-33	Equilibrium	1, 2
34	Growth	1, 2
35	Wrap-up, Course Evaluation	ALL

5.2 Tutorial & Lab Schedule

January						March					
#	Date	Day	Sect.	Room	Activity	#	Date	Day	Sect.	Room	Activity
1	10	w	3	ALEX 309	Problem sets	7	2	f	2	MACN202	Problem sets
	10	w	4	MCKN 315		8	7	w	3	THRN 2336	Matlab
	12	f	2	MACN 202			7	w	4	THRN 2336	
2	17	w	3	ALEX 309	Problem sets		9	f	2	THRN 2336	
	17	w	4	MCKN 315		9	14	w	3	THRN1116	Noise Lab (*)
	19	f	2	MACN 202			14	w	4	THRN1116	
3	24	w	3	THRN 1116	Batch reactors hands-on lab		16	f	2	THRN1116	
	24	w	4	THRN 1116		10	21	w	3	ALEX 309	Problem sets
	26	f	2	THRN 1116			21	w	4	MCKN 315	
4	31	w	3	ALEX 309	Problem sets		23	f	2	MACN202	
	31	w	4	MCKN 315		11	28	w	3	ALEX 309	Problem sets
February							28	w	4	MCKN 315	
#	Date	day	Sect.	Room	Activity	**April**					
4	2	f	2	MACN 202	Problem sets	#	Date	Day	Sect.	Room	Activity
5	7	w	3	THRN 1116	Reactors hands-on lab	11	4	f	2	MACN202	Problem sets
	7	w	4	THRN 1116		(*) Please note that the noise lab will take place mainly outdoors. Wearing appropriate gear is your responsibility.					
	9	f	2	THRN 1116							
6	14	w	3	ALEX 309	Problem sets						
	14	w	4	MCKN 315							
	16	f	2	MACN 202							
7	28	w	3	ALEX 309	Problem sets						
	28	w	4	MCKN 315							

5.3 Lab Schedule

See Section 5.2

5.4 Other Important Dates

January 8: First day of class
February 19 –February 23: Winter Break
March 9: Last drop date – 40th class
March 30: Holiday – no classes
April 6: Last day of classes

6 LAB SAFETY

6.0 School of Engineering Policy

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

If the laboratory rules are not followed, consequences will include removing student's access to the lab. If this results in lab work not being completed, the student will receive a grade of 0.

6.1 ENGG*2560 Specific

Pre-Lab Safety Quiz must be passed prior to starting the lab. You will not be permitted to conduct your lab until all team members have individually passed the quiz (on-line courselink). You may be asked equivalent safety questions in the lab and poor responses may lead to you being asked to leave the lab.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.0 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

8 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or due to a short-term disability, should contact the Student Accessibility Services as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208, email csd@uoguelph.ca or see the website: http://www.uoguelph.ca/csd/

9 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, GTA, technician, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Professor Pensini grants you permission to record or copy his lectures or his other material and to freely use this material for your use only within ENGG*2560 and any of your other University of Guelph courses (suitable citation is expected). Use of this material beyond the University of Guelph requires further permission.

10 RESOURCES

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: http://www.uoguelph.ca/registrar/calendars/index.cfm?index