

Introduction to Industrial Ecology

EVDS 683.48/ENEN 619.12 H(2-1)

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Winter 2017 (Mondays 6:00PM-8:50PM)

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Introduction

This course in *Introduction to Industrial Ecology* is given by the Faculty of Environmental Design (EVDS) as elective course for all students of EVDS and for other students outside EVDS. The philosophy behind the concept of Industrial Ecology is the focus on the understanding of interactions between technical, economical, social and ecological systems and processes. Industrial ecology can also be considered as a concept of dealing with how the industry in its broader term including urban systems, or rather the entire industrial society of today, would work in the future in order to reduce its impact associated with the interference with the life-supporting ecosystems.

This course offered for undergraduate and graduate students equips would-be architects, engineers, planners, business professionals and designers with systems perspective of understanding the implications of the decisions they make at different levels in practicing their profession and acting as consumers.

Requirement of Prior Knowledge

There is no formal prior knowledge requirement.

Objectives

The course aims at presenting the developments in research and application in the field of Industrial Ecology and discussing its role in strategic sustainable development both at the local and global scale with a focus on urban and industrial systems.

After completion of the course the students should be able to:

- i. **Describe** and **explain** the similarities and differences between an ecosystem and an industrial system
- ii. **Describe** and **explain** the concept of industrial ecology(IE) in practice and research
- iii. **Analyse** industrial and urban cases from sustainability performance perspective and **apply** IE concepts in systems such as energy systems and natural resource management
- iv. **Explain** and **analyse** the challenges and opportunities of **IE** from sustainable urbanism/industry
- v. **Explain** the interaction between sustainable consumption and production within the framework of **IE**
- vi. **Evaluate** the relevance of **IE** to practical project examples such a material recycling and energy recovery facility

Moreover, taking the course will provide the opportunity to

- Search information from scientific literature related to **IE** and **summarize** and **analyze** in written reports
- **Summarize** and orally **present** own work and critically discuss work done by others

Teaching Approach

The aforementioned objectives will be realized through engaging students in the following learning activities: **lectures, seminars, one individual assignment and study visit and evaluation,** The lectures together with the course literature make up the basis for preparing for the take-home examination. An In-Class Lab will follow each lecture with a focus on applying the concepts and tools learned to a practical case through group discussion and volunteer presentation. For passing the course, it is compulsory to participate in the seminars.

i. Lectures

An overview of the lectures is shown as follows.

Course - introduction, schedule, literature, projects, project groups

This will introduce the course.

The Metaphor of industrial ecosystem

This aims at exploring the metaphor of industrial ecosystem.

The concept of Industrial Ecology

It outlines current and future key issues in research and practice of industrial ecology covering industrial ecology research, current practice and future developments

Industrial Ecology Tools and Concepts

This will build vocabulary of IE such as Eco-efficiency, life cycle assessment, Natural Step, Factor-4, Factor-10.

Energy and Industrial Ecology

This focuses on the analysis of the contribution of energy systems in the field of Industrial Ecology covering fossil energy systems, renewable energy, IE and energy systems and global energy perspectives.

Sustainable Consumption and the relation to Production: the waste connection

This aims at the explanation of the role of consumption covering traditional outlook of cleaner production, consumption's role, and sustainable consumption.

Sustainability indicator and other metrics and Industrial Ecology

This raises different metrics around sustainable development as its related to industrial ecology.

ii. In-Class Lab

This involves a discussion in groups on the subject treated in the lecture as it applies to the West Campus Development now called University District. The discussion is followed by an "Ignite" Presentation prepared in class for presenting in the next class. Ignite Talks: "20 slides, 15 seconds each, automatically advanced"

iii. Individual Exercise

The individual exercise is to write a reflection of 3 to 4 pages ([times new roman 12 points, single spacing, and 0.5 inches margin on all sides]. on sustainable urban/industrial problems from different parts of the world perspective

1. Describing and **discussing** the similarities and differences in problems between different regions of the world.
2. Describing and **discussing** definitions of sustainable urban/industrial development.

As a reflection, the content of what you write should also cover your own opinion and analysis. A clear distinction of what you take from the other sources and your own analysis determines the possibility of getting the maximum point.

Deadline for submission is on **Monday February 13, 2017 at 11:59 PM** via **Dropbox** in **D2L**. No e-mail submission, please.

iv. **Seminars**

There are two compulsory seminars in the course, Seminar I and Seminar II.

SEMINAR I

Theme: Challenges and opportunities of industrial ecology from a sustainable urbanism/industry perspective

Material for Seminar: “Hammarby Sjöstad – a unique environmental project in Stockholm”.

Hammarby Sjöstad is a new housing project on an old industrial area that started with highly ambitious environmental goals. The project is not completed yet, even though several buildings are finished and already occupied.

Form:

- Reading *the material* in advance
- Instantaneous group formation in the seminar room
- Discussion on the material in groups based on two questions (see below)
- Short oral presentations in groups

Requirement: Prior reading of “Material for Seminar” (see above) and **active participation** in the seminar.

Discussion Questions (DQ)

DQ 1. What are the *opportunities* of Industrial Ecology from a sustainable urbanism perspective?

DQ 2. What are the *challenges* of Industrial Ecology from a sustainable urbanism perspective?

Structure

- Students will be grouped into Discussion Groups
- Half of the groups will discuss on **DQ 1** while the other half will discuss on **DQ 2**
- Each group will make an oral presentation
- Concluding discussion at the end.

The seminar will be structured as:

- 45 minutes - Preparatory discussion within groups
- 15 minutes - Break
- 15 minutes each - Oral presentations by groups on *opportunities*
- 15 minutes - Break
- 15 minutes each - Oral presentations by groups on *challenges*
- 15 minutes - Concluding discussion on *opportunities* and *challenges*

SEMINAR II

Topic: The role of Industrial Ecology in addressing nationally or regionally significant problems related to natural resource extraction and usage (e.g. water resource, coal, minerals, oil sands, etc) from different regions of the world.

Form:

- Forming groups
- Each group works on a natural resource problem

Preparation for group work

- v. Each group proposes **two to three** natural resource problems

Course Outline

- vi. Each group submits a description of the **proposals** motivating the proposal (half page each, [times new roman 12 points, single spacing, and 0.5 inches margin on all sides]) by **Monday January 30, 2017 at 11:59 PM** via **Dropbox** in **D2L**.
The motivating description should highlight, among other things, the type, significance, system boundary of the problem.
- vii. **One** of the proposals will be selected by the instructor accounting for significance, scale and geographical representation as well as problem type. Groups will be informed regarding the selected problem by **Thursday February 2, 2017**.
- viii. Each group works on the **selected** problem using the structure shown next as starting point.

Group work

Each group analyses the problem approved in a structured way using information from offline and online literature based on, but not limited to, the following aspects:

- Scope of the problem
- What is the contextual setting of the problem
- What kind and magnitude of environmental, economic and social issues are associated with the problem? (Use figures when necessary and possible)
- How is the problem being handled right now?
- How **best** can the problem be handled or solved?
- What kind of role do you think **Industrial Ecology** has in solving the problem and preventing the problem from occurring somewhere else? Outline.
- Critically analyse the enabling conditions and the constraints for **IE** application in addressing the specific problem under the prevailing context
- Compare and contrast the different aspects of employing **IE** approach and conventional approach
- Upload your PowerPoint file on **D2L** before **Sunday March 26, 2017 at 2 PM**.

Maximum point will be given to those who address all aforementioned issues fully and in detail. Due consideration will be given to **substance and quality** at all levels such as excellence in oral and power point presentation as well as critical analysis in discussions.

The seminar will be structured so that each group is assigned to act as an opponent for another presenting group. Each presentation will also be graded by the opponent group and all other groups on the basis of the presentation and discussion. The grades by each group will be submitted with a motivation via gassefa@ucalgary.ca latest at **Thursday March 30, 2017 11:59 PM**.

ix. Study visit and evaluation

The study visit is to a facility in Calgary that works on material recovery.

Requirement: Write one page analysis relating the knowledge you gained in the course with different aspects of the facility.

Date of visit: **Monday March 13, 2017 at 2PM**

Place: Materials Recovery Facility

To arrive there: Information will be provided later.

Deadline for submission is on **Friday March 20, 2017 at 6 PM** via **Dropbox** in **D2L**.

Means of Evaluation

The basis for final grade of the course will be composed of points achieved in the five components of the course namely, Individual Assignment, Seminar I, Seminar II, Study Visit and Evaluation, and Take-home Exam. Class Participation is included as part of Seminar I and II. This take-home examination forms one individual part of the overall assessment of the course. The questions will be available on D2L by **Saturday April 15 2017**. The deadline for submitting the answers via **Dropbox in D2L** is **Saturday April 22, 2017 at 6PM**. Full instruction on the take-home examination will be posted on **D2L**.

The points from the four components will be added as follows:

1. Individual Assignment	15
2. Seminar I	15
3. Seminar II	20
4. Study Visit and Evaluation	10
5. In-Class Lab Participation	10
6. Take-home Exam	<u>30</u>
	100

Final grades will be reported as letter grades, with the final grade calculated according to the 4-point range. Correspondence between letter grades and 4-points scale will be based on the following grading scale.

Grade	Grade Point Value	4-Point Range	Percent	Description
A+	4.00	4.00	95-100	Outstanding - evaluated by instructor
A	4.00	3.85-4.00	90-94.99	Excellent - superior performance showing comprehensive understanding of the subject matter
A-	3.70	3.50-3.84	85-89.99	Very good performance
B+	3.30	3.15-3.49	80-84.99	Good performance
B	3.00	2.85-3.14	75-79.99	Satisfactory performance
B-	2.70	2.50-2.84	70-74.99	Minimum pass for students in the Faculty of Graduate Studies
C+	2.30	2.15-2.49	65-69.99	All final grades below B- are indicative of failure at the graduate level and cannot be counted toward Faculty of Graduate Studies course requirements.
C	2.00	1.85-2.14	60-64.99	
C-	1.70	1.50-1.84	55-59.99	
D+	1.30	1.15-1.49	50-54.99	
D	1.00	0.50-1.14	45-49.99	
F	0.00	0-0.49	0-44.99	

Notes:

- A student who receives a "C+" or lower in any one course will be required to withdraw regardless of their grade point average (GPA) unless the program recommends otherwise. If

the program permits the student to retake a failed course, the second grade will replace the initial grade in the calculation of the GPA, and both grades will appear on the transcript.

Communication and Submission

Students are encouraged to contact course administration as follows,

Regarding the course as a whole:

E-mail: gassefa@ucalgary.ca

Phone: 403 220 6961

In person: PF 3191

Note that all submission of assignments should **ONLY** be done via **DropBOX in D2L**.

Notes:

1. Written work, term assignments and other course related work may only be submitted by e-mail if prior permission to do so has been obtained from the course instructor. Submissions must come from an official University of Calgary (ucalgary) email account.
2. Academic Accommodations. Students who require an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to their Instructor or the designated contact person in EVDS, Jennifer Taillefer (jtaillef@ucalgary.ca). Students who require an accommodation unrelated to their coursework or the requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Vice-Provost (Student Experience). For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/
3. Plagiarism - Plagiarism involves submitting or presenting work in a course as if it were the student's own work done expressly for that particular course when, in fact, it is not. Most commonly plagiarism exists when:(a) the work submitted or presented was done, in whole or in part, by an individual other than the one submitting or presenting the work (this includes having another impersonate the student or otherwise substituting the work of another for one's own in an examination or test),(b) parts of the work are taken from another source without reference to the original author,(c) the whole work (e.g., an essay) is copied from another source, and/or,(d) a student submits or presents work in one course which has also been submitted in another course(although it may be completely original with that student) without the knowledge of or prior agreement of the instructor involved. While it is recognized that scholarly work often involves reference to the ideas, data and conclusions of other scholars, intellectual honesty requires that such references be explicitly and clearly noted. Plagiarism is an extremely serious academic offence. It is recognized that clause (d) does not prevent a graduate student incorporating work previously done by him or her in a thesis. Any suspicion of plagiarism will be reported to the Dean, and dealt with as per the regulations in the University of Calgary Graduate Calendar.
4. Information regarding the Freedom of Information and Protection of Privacy Act (<http://www.ucalgary.ca/secretariat/privacy>) and how this impacts the receipt and delivery of course material
5. Emergency Evacuation/Assembly Points (<http://www.ucalgary.ca/emergencyplan/assemblypoints>)
6. Safewalk information (<http://www.ucalgary.ca/security/safewalk>)
7. Contact Info for: Student Union (<https://www.su.ucalgary.ca/contact/>); Graduate Student representative (<http://www.ucalgary.ca/gsa/>) and Student Ombudsman's Office (<http://www.ucalgary.ca/ombuds/>).

Recommended (NOT Required) Course Literature

1. Graedel, T.E., and Allenby, B.R. (2003) Industrial Ecology, Prentice Hall.
2. Erkman, S. and Ramaswamy, R. (2003) Applied Industrial Ecology - A New Platform for Planning Sustainable Societies
3. peer-review journal articles relevant for each component will also be provided

For Take-home Exam

Ayres and Ayres (2002) A Handbook of Industrial Ecology, Edward Elgar Pub. Cheltenham, UK.
[Full Text Available Online Through the UofC Library]

Additional information

The latest changes and news about the course will available at D2L.

Schedule

Activity	Topic	Date	Time	Venue	Instructor
Lecture 1	Course Introduction	Monday, Jan 9	18:00 - 20:50	PF2140	GA
Lecture 2	The Metaphor of Industrial Ecosystem	Monday, Jan 16	18:00 - 20:50	PF2140	GA
Lecture 3	Industrial Ecology Tools and Concepts	Monday, Jan 23	18:00 - 20:50	PF2140	GA
Lecture 4	Energy and Industrial Ecology	Monday, Jan 30	18:00 - 20:50	PF2140	GA
Seminar I	Industrial Ecology and Sustainable Urbanism	Monday, Feb 6	18:00 - 20:50	PF2140	GA
Lecture 5	Sustainable Consumption and the relation to production	Monday, Feb 13	18:00 - 20:50	PF2140	GA
Lecture 6	Sustainability Indicators and Industrial Symbiosis Cases	Monday, Feb 27	18:00 - 20:50	PF2140	GA
Lecture 7	Industrial Ecology and Data	Monday, Mar 6	18:00 - 20:50	PF2140	GA
Study Visit	Study Visit to Calgary's Materials Recovery Facility	Monday, Mar 13	14:00-15:00	Information will be provided later	GA
Lecture 8	Industrial Ecology and the Manchester Project	Monday, Mar 20	18:00 - 20:50	PF2140	NK
Seminar II	Natural Resource Extraction and Utilization	Monday, Mar 27	18:00 - 20:50	PF2140	GA
Lecture 9	Industrial Ecology Applications and Research and Discussion on the Results of the Exercise	Monday, Apr 3	18:00 - 19:30	PF2140	GA
Lecture 10	University District Development and Industrial Ecology	Monday, Apr 10	19:35 - 20:50	PF2140	TO

GA: Getachew Assefa; NK: Noel Keough; TO: Travis Oberg.