

Environmental **DESIGN**

architecture + landscape architecture + planning

University of Calgary/Faculty of Environmental Design

Advanced Special Topics in Environmental Design (Introduction to Industrial Ecology)

EVDS 683.48/ENEN 619.12 H(2-1)

Thursdays, 18:00-21:10 PF 2160

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Winter 2019

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, economic, 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.

Objectives – Course Learning Outcomes

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. **Analyze** 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 **analyze** 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. Students will do a required reading and a brief of two pages and 3-5 minutes pre-recorded video summarizing the reading. An In-Class Lab will follow each lecture with a focus on applying the concepts and tools learned to a practical case of a virtual industrial park in Calgary through group discussion. For passing the course, it is compulsory to participate in the discussion.

1) **Briefs**

For lectures 2-6, individually choose one of the readings and summarize it in 2 pages and 3-5 minutes pre-recorded video to be submitted via D2L by 6 pm of the day before the lecture.

2) **In-Class lab**

This is a discussion in group on the subject treated in the lecture as it applies to a virtual industrial park in Calgary.

3) **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.

The content of what you write should also reflect on 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 **Wednesday February 6, 2019** via **Dropbox** in **D2L**. No e-mail submission is possible.

4) **Seminars**

There are two compulsory seminars in the course, Seminar 1 and Seminar 2.

Seminar 1

Industrial Ecology

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 2

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

- 5) Each group proposes **two to three** natural resource problems
- 6) 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 **Wednesday January 30, 2019** via **Dropbox** in **D2L**.

The motivating description should highlight, among other things, the type, significance, system boundary of the problem.

- 7) **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 **Friday February 1, 2019**.
- 8) 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 analyze 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 **Monday April 1, 2019 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 Saturday April 6, 2019.

9) 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 focusing on the potential for local industries to be developed based on the facility.

Date of visit: Thursday March 21, 2019 at 2PM (tbc)

Place: Materials Recovery Facility

To arrive there: Information will be provided later.

Deadline for submission is on **Saturday March 23, 2019** via **Dropbox** in D2L.

Content: Topic Areas & Detailed Class Schedule

An overview of the topics is shown as follows.

Introduction, background, literature, assignment, groups, schedule

This will introduce the course.

What and Why IE: the metaphor of industrial ecosystem

This aims at exploring the metaphor of industrial ecosystem.

Material aspects of IE: sustainable consumption and production

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

Energy and IE

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.

Industrial ecology tools and concepts

This topic will be about building IE vocabularies such as Eco-efficiency, life cycle assessment, Natural Step, Factor-4, Factor-10.

Sustainability indicators and other metrics and industrial ecology

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

IE application and research areas

This outlines current and future key issues in research and practice of industrial ecology.

Tentative schedule

Class room: PF 2160

| Activity | Topic | Date | Time | Remark |
|---------------|--|--------|---------------|----------|
| Lecture 1 | Course introduction | Jan 10 | 6:00 - 9:10pm | |
| Lecture 2 | What and why IE: metaphor of industrial ecosystems | Jan 17 | 6:00 - 9:10pm | |
| Lecture 3 | Materials and IE: sustainable consumption and production, industrial symbiosis | Jan 24 | 6:00 - 9:10pm | |
| Lecture 4 | Energy and IE | Jan 31 | 6:00 - 9:10pm | |
| Lecture 5 | IE concepts and tools | Feb 7 | 6:00 - 9:10pm | |
| Lecture 6 | Sustainability indicators: IE and data | Feb 14 | 6:00 - 9:10pm | |
| Seminar 1 | IE and sustainable urbanism | Feb 28 | 6:00 - 9:10pm | |
| Lecture 7 | IE applications and research | Mar 7 | 6:00 - 9:10pm | |
| Study visit | Calgary's materials recovery facility | Mar 21 | 2:00-3:00pm | tbc |
| Guest lecture | IE concepts in the Manchester Project | Mar 28 | 6:00 - 9:10pm | NK (tbc) |
| Seminar 2 | Natural resource extraction and utilization | Apr 4 | 6:00 - 9:10pm | GA |
| Guest lecture | IE concepts in West Campus Development | Apr 11 | 6:00 - 9:10pm | tbc |

Feb 21 and March 14 no classes GA: Getachew Assefa

NK: Noel Keough

Means of Evaluation

The basis for final grade of the course will be composed of points achieved in the six components of the course namely, **Individual Assignment, Brief summary and video, Seminar 1, Seminar 2, Study Visit and Evaluation, and Take-home exam.** Note that all submission of assignments should ONLY be done via Dropbox in D2L.

The take-home examination forms one individual part of the overall assessment of the course. The questions will be available on D2L by **Saturday April 20, 2019.** The deadline for submitting the answers via **Dropbox in D2L** is **Saturday April 27, 2019.** Full instruction on the take-home examination will be posted on **D2L.**

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

| | |
|-------------------------------------|-----------|
| 1. Individual assignment | 10 |
| 2. Brief summary on and video (5x5) | 25 |
| 3. Seminar 1 | 20 |
| 4. Seminar 2 | 20 |
| 5. Study visit and evaluation | 10 |
| 6. Take-home exam | <u>15</u> |
| | 100 |

Grading Scale

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.

Readings

Required readings:

- peer-review journal articles relevant for each component will be provided as part of the Briefing exercise

(NOT required) course books:

- Graedel, T.E., and Allenby, B.R. (2003) *Industrial Ecology*, Prentice Hall.
- Erkman, S. and Ramaswamy, R. (2003) *Applied Industrial Ecology - A New Platform for Planning Sustainable Societies*

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]

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. Appeals: If a student has a concern about the course, academic matter, or a grade that they have been assigned, they must first communicate this concern with the instructor. If the concern cannot be resolved with the instructor, the student can proceed with an academic appeal, which normally begins with the Faculty: <http://www.ucalgary.ca/provost/students/ombuds/appeals>
5. Information regarding the Freedom of Information and Protection of Privacy Act (<https://www.ucalgary.ca/legalservices/foip>)
6. Emergency Evacuation/Assembly Points (<http://www.ucalgary.ca/emergencyplan/assemblypoints>)
7. Safewalk information (<http://www.ucalgary.ca/security/safewalk>)
8. Contact Info for: Student Union (<https://www.su.ucalgary.ca/contact/>); Graduate Student representative(<https://gsa.ucalgary.ca/about-the-gsa/gsa-executive-board/>) Student Union Wellness Centre: <https://www.ucalgary.ca/wellnesscentre/>; Library Resources: <http://library.ucalgary.ca/> and Student Ombudsman's Office (<http://www.ucalgary.ca/ombuds/>).