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# ENVIRONMENTAL ASPECTS OF THE BUILT ENVIRONMENT AG 2806 (7,5 HP)

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COURSE PM, 2019-10-22

## COORDINATOR:

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## TEACHING UNIT:

Department of Sustainable Development, Environmental Science and Engineering (SEED),  
School of Architecture and Built Environment.

VISITING ADDRESS: Teknikringen 10b. We encourage you to make an appointment before seeing us as we are often away from office.

WEBSITE: <https://www.seed.abe.kth.se/>

## WELCOME TO THE COURSE!

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Please take your time and read this carefully. Read it twice! It contains important information about the course!

## INTRODUCTION

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The overall aim of the course is to give you understanding about the interplay between humans, buildings and the surrounding environment as well as strategies for reducing environmental impacts from buildings. The course is designed to give you a profound understanding about the environmental impacts of the built environment in relation to specific settings and contexts and the ability to suggest and argue for relevant approaches for assessing and addressing the environmental impact in planning situations that you might encounter in your future profession.

## COURSE OBJECTIVES

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After completing the course, you will be able to:

- Describe the potential environmental and health impacts caused by different stages in a building's life span.
- Be able to analytically discuss environmental hotspots regarding the built environment depending on local contexts and building types.
- Suggest relevant planning strategies to reduce the environmental impact both from new building developments and improvements of the existing building stock.
- Suggest relevant types of evaluation and assessment tools for decision contexts related to planning and management of buildings.
- Account for current national strategies to reduce the environmental impact of the built environment.

## CANVAS

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We will use the Canvas web platform in the course. Please make sure that you get your KTH-ID (the same as your KTH email address) and that you get registered to the course as soon as possible so that you can log in to Canvas. The address to the course page on Canvas is:

<https://kth.instructure.com/courses/12709>

Most of the information you will need on Canvas will be organized in the Modules tab.

## EXAMINATION

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The course is graded A-F. Examination of course objectives includes a two-part written take-home exam (graded A-F), a group project, (graded A-F), and a computer lab (graded Pass/Fail). The final grade is a weighted average of the written take-home exam and the project work in group. In order to receive a final grade, you must fulfil the requirements for an "E" for the written exam and project work, as well as achieving a "Pass" grade on the computer lab.

A grade denoted Fx is also included in the scale. It represents a failing grade at the boundary between pass/fail. In this case, you can write a complementary assignment to reach the grade E for the course.

## WRITTEN TAKE-HOME EXAM

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The written take-home exam is in two parts. You will write Part 1 at the end of the course (see schedule below). Part 2 consists of a short essay and is written alongside the project work during the course. Don't wait until the end of the course to work on Part 2! Both parts are handed in together on Canvas before the deadline for the take-home exam at the end of the course (see the schedule at the end of this document).

The home exam is graded A-F overall. The grade Fx denotes a failed grade, but with the possibility to pass the home exam by oral examination. After the oral examination, a student previously awarded the grade Fx can only receive the grade E for the home exam. Re-exams will only be given to students who have missed or failed previous examination occasions.

## COMPUTER LAB

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The computer lab includes an assignment that must be uploaded on Canvas. To pass, the computer lab assignment should be completed and handed in on time according to the instructions.

## PROJECT WORK AND GRADING

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Your project work will be graded A-F. Grading criteria will be given in the project memo.

## MEETINGS & LECTURES

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In this course, lectures take place in the form of course meetings. Rather than lectures in a traditional sense, these are designed as seminars around a number of core course themes. The teachers will introduce the themes, sometimes with lectures (including guest lecturers). However, course meetings will also be devoted to discussing or working with the course literature or the group assignments. You will be asked to prepare “meeting assignments” that should be uploaded before the meeting and will be discussed during the meeting. To get the most out of the course meetings and to make these run smoothly **it is important that you read the requested literature in advance**. The aim of the course meetings is to support you to actively work on the right tasks throughout the course. **Active preparation and participation during these meetings will greatly improve your ability to pass the course.**

## MEETING ASSIGNMENTS

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For four of the meetings (indicated below), **you are required to submit a prepared assignment** on CANVAS before the meeting. Assignments will be to some extent related to the project work. Make sure that you can access your assignment during the class (by printing it or bringing your computer) since we will use assignments as the basis for discussions. In order to pass the course, at least 2 out of these 4 assignments should be submitted in time.

## MEETINGS, ASSIGNMENTS, DELIVERABLES

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### MEETING 1 – INTRODUCTION TO THE COURSE AND SOME CONCEPTS

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You will get an introduction to the course, important practical information and we will start elaborating on and working with the main topics of the course in seminar form.

#### **To read in advance:**

*The course PM*

*Swedish Environmental Protection Agency. (2018). Sweden's environmental objectives: an introduction. <http://www.swedishepa.se/Documents/publikationer6400/978-91-620-8820-0.pdf?pid=23427>. (the green text about each objective at the top of each page is essential. Other information on these pages can be skimmed).*

#### **Recommended reading (throughout the course):**

*Wheeler & Beatley (Eds.) (2014) The Sustainable Urban Development Reader, 3rd edition.*

Routledge, Oxon. You can read chapters 19, 21, 22 and 35. Also skim through Part 6 "Case studies of urban sustainability", pp. 393-453.

Note that meetings 2 and 3 happen the day after meeting 1, so it is recommended to read the literature for meetings 2 and 3 before meeting 1.

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## MEETING 2 –ENERGY AND MATERIAL FLOWS: ENVIRONMENTAL IMPACTS

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Meetings 2 and 3 both aim to give a broad understanding of how the use of energy, water and materials in the building sector affects people and the environment. The meetings will also address the issue of what aspects to prioritize when working with a building's environmental performance depending on the climate, building phase, scope etc. Strategies for reducing these problems will be briefly discussed. Meeting 2 will deal specifically with the impact of these resource flows on the environment.

### **To read in advance (literature for meetings 2 and 3):**

Pages 58-77 in Dammann, S. (2004). *Environmental indicators for buildings*. Hörsholm, Denmark: By og Byg – Danish building and Urban Research. (20 p.)

Pages 8-21 in Lenz, B., Schreiber, J., and Stark, T.(2011) *Sustainable building services. Principles, systems, concepts*. Munich, Institut für international Architektur-Dokumentation. (14 p.)

Toller, S, Wadeskog, A, Finnveden, G, Malmqvist, T, Carlsson, A. (2011). *Energy use and environmental impact of the Swedish building and real estate management sector*. *Journal of Industrial Ecology*, 15, 3, pp. 394-404 (11p).

Pages 269-271, 278-281, 625-628 in Bokalders, V, Block, M. (2010). *The Whole Building Handbook. How to design Healthy, Efficient and Sustainable Buildings*. London: Earthscan. (11 p.)

### **Recommended further reading:**

Chapters 26 (starts p. 197) and 29 (starts p. 224) in Wheeler & Beatley (Eds.) (2014) *The Sustainable Urban Development Reader*, 3<sup>rd</sup> edition. Routledge, Oxon.

Krook, J, Carlsson, A, Eklund, M, Frändegård, P, Svensson, N. (2011). *Urban mining: hibernating copper stocks in local power grids*. *Journal of Cleaner Production*, vol 19, pp. 1052-1056.

### **To prepare (Meeting 2 assignment):**

Consider the following examples of buildings:

- A high-rise office building in downtown Jakarta.
- A single family house in the suburbs of Stockholm.

With help from the literature for meetings 2-3, briefly discuss the following points:

- To what extent might the buildings differ regarding the human needs they must address and their impact on human beings?
- To what extent might the buildings differ regarding their local and global environmental impacts? Do different environmental impacts need to be prioritized in each case?
- What kind of "built environment solutions" could be considered in order to minimize the environmental impacts arising from each building?

If you need information that is not in the literature for meetings 2-3, consider using online searches. You are allowed to speculate, but you should make it clear whether what you write is based on verified facts or speculation.

Submit your answers (1-2 pages, concise answers or bullet points) to Canvas before the meeting and bring them to the meeting as printed copies or on your computer. These notes will be used as a basis for group discussion during the meeting.

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### MEETING 3 – ENERGY AND MATERIAL FLOWS: HAZARDOUS SUBSTANCES

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This meeting is the continuation of meeting 2. It will focus more particularly on flows of hazardous substances in construction materials, and how the related health and environmental impacts can be mitigated. The literature for this seminar is Lenz, Schreiber & Stark (2011) and Bokalders & Block (2010) which you should have read for meeting 2.

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### MEETING 4 – INDOOR ENVIRONMENTAL QUALITY AND HEALTH

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Buildings aim to provide us with shelter, work places, etc. We spend 90 % of our time indoors. The quality of the indoor environment is thus an important issue when talking about green buildings. The aim of the meeting is to introduce the wide array of indoor environmental issues which may arise in buildings, their potential severity and their relation to buildings and the surrounding built environment.

#### **To read in advance:**

*Pages 469-472 in Malmqvist, T (2008). Environmental rating methods: selecting indoor environmental quality (IEQ) aspects and indicators. Building Research & Information 36 (5), pp. 466-485. (4 p.)*

*Pages 79-87 in Dammann, S. (2004). Environmental indicators for buildings. Hörsholm, Denmark: By og Byg – Danish building and Urban Research. (9 p.)*

*Pages 112-114 and 182-185 in Bokalders, V, Block, M. (2010). The Whole Building Handbook. How to design Healthy, Efficient and Sustainable Buildings. London: Earthscan. (7 p.)*

*Pages IX-XIV - English summary in Hult, M. (2002). Assessment and Assurance of Indoor Environment Qualities in Buildings during Program, Design and Management phases. Gothenburg: Chalmers University of Technology. PhD thesis in Swedish. (5 p.)*

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### MEETING 5 – URBAN NATURAL ENVIRONMENT – VALUES, THREATS, OPPORTUNITIES

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The meeting aims to give a broad understanding of significant environmental aspects related to how the built environment interacts with the surrounding non-built environment and vice versa. It will address how urban nature can mitigate local environmental problems, help reduce the urban environmental footprint and support the well-being of residents.

#### **To read in advance:**

*Pedersen Zari. (2012). Ecosystem services analysis for the design of regenerative built environments. Building Research & Information, 40 (1), pp. 54-64 (10p).*

Maas, J., Verheij, R. A., Groenewegen, P. P., de Vries, S., & Spreeuwenberg, P. (2006). Green space, urbanity, and health: how strong is the relation? *Journal of Epidemiology & Community Health*, 60, 587–592.

Bokalders, V and Block, M. (eds). 2015. *Urban ecosystem services: Let nature do the work. A summary of c/o city*. (Read pp 14-44) Open access here: <http://bygg.stockholm.se/Global/C.pdf>

Depietri, Y and McPhearson, T. 2017. Integrating the grey, green and blue in cities: Nature-based solutions for climate change adaptation and risk reduction. Pp 91-109 in Kabisch et al. (eds) 2017. *Nature-based solutions to climate change adaptation in urban areas. Linkages between science, policy and practice*. Springer open. Open access here: <http://www.springer.com/la/book/9783319537504>

### **Optional reading:**

Kabisch et al. (eds) 2017. *Nature-based solutions to climate change adaptation in urban areas. Linkages between science, policy and practice*. Springer open. Open access here: <http://www.springer.com/la/book/9783319537504>

Beatley, T and Newmann, P. (2013). *Biophilic cities are sustainable, resilient cities*. *Sustainability*, 5, pp. 3328-3345.

Tratalos, J et al. (2007). *Urban form, biodiversity potential and ecosystem services*. *Landscape and Urban Planning*, 83, pp. 308-317.

Pages 205-223 - Part of chapter 7 in Beatley, T. (2000). *Green Urbanism – learning from European Cities*. (19 p.)

Pages 48-63 (chapter 3) in Halweil, B. & Nierenberg, D. (2007) *Farming the Cities*. In *Worldwatch Institute (2007) 2007 State of the World: Our Urban Future*. W.W. Norton & Company, London.

### **To prepare (Meeting 5 Assignment):**

Read the literature and answer the following questions (1-2 pages, bullet form is fine if you want) and bring it to the meeting in 2-3 printed copies or on your computer:

1. Which advantages are there/Why is it important to integrate nature into the built environment?
2. How can construction (of buildings or other material infrastructure) on green areas and natural environments have a negative effect on urban areas, people and ecosystems?

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## **MEETING 6 –INDICATORS AND APPROACHES FOR ASSESSING ENVIRONMENTAL IMPACTS AND CONSEQUENCES**

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The meeting aims to introduce environmental indicators, the different ways in which they may be categorized, and in which situations different types of indicators may be more or less relevant. We will also work with how to formulate adequate environmental targets and indicators for following up targets.

### **To read in advance:**

Smeets, E, Weterings, R. (1999). *Environmental indicators: Typology and overview*. Copenhagen: European Environmental Agency. (11 p.)

Finnveden, G, Moberg, Å. (2005). *Environmental systems analysis tools - an overview*. *Journal of Cleaner Production*, 13 (12), pp. 1165-1173. (9 p.)

Pages 322-324 - sections "perspectives on environmental indicators" and "procedure for choosing indicators" in Malmqvist, T, Glaumann, M. (2006). *Problem-related environmental indicators for housing management*. *Building Research & Information*, 34 (4), pp. 321-333. (4 p.)

**Recommended further reading:**

chapters 48 (start p. 367) and 49 (start p. 375) in Wheeler & Beatley (Eds.) (2014). *The Sustainable Urban Development Reader*, 3rd edition. Routledge, Oxon.

**To prepare (Meeting 6 Assignment):**

1. Read the text about DPSIR (Smeets and Weterings). Select two different indicators in Miljöbyggnad (you find it under Course literature on Canvas: MB new buildings). For each one of them, reflect shortly on whether they are D, P, S, I or R indicators and argue for why you think that.
2. Read the text by Malmqvist and Glaumann. Which "endpoint problems" do you think the indicators intend to measure?
3. Discuss briefly how valid and costly you think the indicators are (also based on the definition of Validity and Cost in the text for today by Malmqvist and Glaumann)

Submit your answers (1-2 pages, concise answers or bullet points) to Canvas before the meeting and bring it to the meeting as printed copies or on your computer. These notes will be used as a basis for group discussion during the meeting.

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## MEETING 7 - LIFE CYCLE APPROACHES

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The meeting aims to give a basic introduction to life cycle thinking and life cycle assessment (LCA). Furthermore, it will give insights into how and when life cycle approaches can be used to assess environmental impacts from buildings.

**Literature introducing LCA (skim through it if you already know about LCA):**

Finnveden, G., Potting, J. (2014). Life cycle assessment. In: Wexler, P. (Ed.), *Encyclopedia of Toxicology*, 3rd edition vol 3. Elsevier Inc., Academic Press, pp. 74-77.

Buyle, M., Braet, J., & Audenaert, A. (2013). Life cycle assessment in the construction sector: A review. *Renewable and Sustainable Energy Reviews*, 26, 379-388.

**State of the art of building LCA and example of recent study:**

Anand, C. K., & Amor, B. (2017). Recent developments, future challenges and new research directions in LCA of buildings: A critical review. *Renewable & Sustainable Energy Reviews*, 67, 408-416. doi: 10.1016/j.rser.2016.09.058

Larsson, M., Erlandsson, M., Malmqvist, T., & Kellner, J. (2017). *Constructing an apartment building with exterior walla and frames of cross-laminated timber - the Strandparken residential tower* (Report No. B2260-PEng). Stockholm, Sweden: IVL Swedish environmental research institute.



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## MEETING 8 – HOW CAN YOU TELL IF A CITY IS SUSTAINABLE OR NOT?

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The aim of this meeting is to provide an understanding of environmental aspects at the level of a city or a city district, i.e. what is a sustainable city? What aspects need to be considered when talking about sustainability of cities? Is it really all about CO<sub>2</sub>? How should we define the system boundaries for a city or a city district? However, all change processes need to consider not only what to change, but also who is responsible for these changes. How then can we drive sustainability issues in urban development projects? Inspiration will be given by a guest lecturer.

### **To read in advance:**

*Kramers, A., Wangel, J., Johansson, S., Höjer, M., Finnveden, G., Brandt, N. (2013) Towards a comprehensive system of methodological considerations for cities' climate targets. Energy Policy 62, pp. 1276–1287 (11 p)*

*Wangel, J., Wallhagen, M., Malmqvist, T., Finnveden, G. (2015) Certification systems for sustainable neighbourhoods: What do they really certify? Environmental Impact Assessment Review 56, pp. 200-213. DOI: 10.1016/j.eiar.2015.10.003*

*Kennedy, C., Pincetl, S., Bunje, P. (2011) The study of urban metabolism and its application to urban planning and design. Environmental Pollution 159, pp. 1965-1973.*

### **Recommended further reading:**

Wachsmuth D. (2012) Three ecologies: urban metabolism and the society-nature opposition. *The sociological quarterly* 53, pp. 506-523.

Williams, K. & Dair, C. (2007). A framework for assessing the sustainability of brownfield developments. *Journal of Environmental Planning and Management* 50(1), pp. 23-40. (18 p)

Holman, N. (2009) Incorporating local sustainability indicators into structures of local governance: a review of the literature. *Local Environment*, Vol. 14 (4), pp. 365-375. (10 p.)

### **To prepare (Meeting 8 Assignment):**

Each one of you shall search for a cutting-edge practical example of a completed or ongoing sustainable neighborhood project. Try to find documentation in the form of a sustainability/environmental program for the project or similar. Prepare a 1-2 page reflection concerning the following questions:

- How are sustainability aspects assessed, evaluated and followed up?
- Do you think there are any useful examples of targets and indicators that you can use in your project work? Which?
- Comment briefly also on if you consider the case to be “sustainable” or not.

Submit your answers (1-2 pages, concise answers or bullet points) to Canvas before the meeting and bring it to the meeting as printed copies or on your computer. These notes will be used as a basis for group discussion during the meeting.



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## WRITTEN EXAM

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Part 1 of the exam will cover what we have brought up in the course meetings. It is a take-home exam which will be posted on Canvas at 9 am on Tuesday January 7<sup>th</sup> 2020. You can upload your answers by **17.00 on Thursday January 9<sup>th</sup> 2020 at the latest.**

Part 2 of the exam takes the form of a short essay that relates to topics you deal with in the project work and that are brought up in meetings and project seminars. This part of the exam is presented at the end of the final seminar in December. However, the written instruction is available at Canvas from the beginning of the course. This means that you can work on this essay at any time you wish during the course. Students' answers to both parts 1 and 2 of the exam should be submitted together no later than **17.00 on Thursday January 9<sup>th</sup> 2020.**

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## COMPUTER LAB

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The computer lab gives you practical experience of using a tool for environmental assessment of building renovation measures. The tool will be introduced during the lab session which also comprises an assignment which you carry out with the help of the tool. In order to pass the course you need to upload the assignment to Canvas no later than the deadline given in the course schedule below.

### **To read in advance:**

Glaumann, M. Environmental strategy in building design – a basic tool to support early decision making in new construction and refurbishment processes. Proceedings of World Sustainable Building 2014, Barcelona.

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## PROJECT WORK

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The project work connects theory to practice by working with a specific urban development case. The teachers form groups of 4-6 people and devise the cases. These are the important activities of the group work:

- Team work and individual work, student led
- 2 project seminars and 1 occasion for group supervision
- Final seminar with presentations and discussion of results
- Revision of reports after final seminar

You are required to deliver a number of items in order to pass the project work:

- Project work plan
- Draft group report
- Revised group report
- A critical review of another group's work
- An individual reflection on your group work

**Read through the project instructions on Canvas carefully. It contains all important information about the project work!**

## PROJECT SEMINARS AND SUPERVISION

Compulsory project seminars and supervision will help you in your project work. You will be introduced to the task and work steps, work together with group exercises that support the project work, receive relevant background information and get an opportunity to discuss your project issues with course mates and teachers. Make sure you prepare well before the seminars and supervision as you will all benefit from this. Detailed instructions on what to read and prepare are found in the Project work instructions on Canvas.

## FINAL SEMINAR

Project reports are presented at a final seminar. After the seminar, your teacher will send comments and required revisions of the report by email. The final draft of the report shall be posted on Canvas no later than the deadline given in the course schedule below. Detailed instructions on what to prepare before the seminar are found in the Project work instructions on Canvas.

## SCHEDULE

Day	Date	Start time	End time	Room (if applicable)	Description	Teaching staff (if applicable)
Thurs	2019-11-07	09:00	12:00	Meeting 1: Introduction to the course and some key concepts	V3	TM
Fri	2019-11-08	09:00	12:00	Meeting 2: Energy and material flows: Environmental impacts	V34	NF, LD
Fri	2019-11-08	13:00	16:00	Meeting 3: Energy and material flows: Hazardous substances	V32	TM, JF
Thu	2019-11-14	09:00	12:00	Meeting 4: Indoor environmental quality	K53	TM
Fri	2019-11-15	09:00	12:00	Project seminar 1	Q24	TM, JL
Fri	2019-11-15	13:00	16:00	Meeting 5: Urban natural environment – values, threats and opportunities	E2	SB
Wed	2019-11-20	09:00	12:00	Meeting 6: Indicators and approaches for assessing environmental impacts	K53	TM
Thurs	2019-11-21	09:00	12:00	Project seminar 2	E53	TM, JL
Fri	2019-11-22	09:00	12:00	Meeting 7: Life cycle approaches – LCA	Q34	NF
				Deadline project workplan		
Thurs	2019-11-28	09:00	12:00	Meeting 8: How can you tell if a city is sustainable or not?	E53	TM, ES
Fri	2019-11-29	09:00	16:00	Computer lab	Frodo	NF
Thurs	2019-12-05	13:00	17:00	Project supervision		TM, JL, ÖS, EE
Thurs	2019-12-05		18:00	Deadline submission computer lab report		
Fri	2019-12-06	09:00	17:00	Time for work in project groups		
Mon	2019-12-09	09:00	17:00	Time for work in project groups		
Tue	2019-12-10		17:00	Deadline: submission report draft		
Fri	2019-12-13	08:00		Deadline: Individual critical review of another group report		
Fri	2019-12-13	08:00	12:00	Final seminar	Sahara + Taiga, Teknikringen 10b	TM, JL

Tues	2019-12-18		17:00	Deadline for submission of final project report		
Tues	2020-01-07	9:00		Home exam part 1 is posted to Canvas		
Thurs	2020-01-09		17:00	Deadline for uploading home exam parts 1 and 2 to Canvas		

Meetings and project seminars include the 'academic quarter' – i.e. they start at **15 minutes past** the hour at the times shown.

TM: Tove Malmqvist

NF: Nicolas Francart

JL: Jonas Lind

LD: Ludvig Dahlgren (Skanska)

JF: Jenny Fäldt (Stockholm municipality)

SB: Sara Borgström

ÖS: Örjan Svane

EE: Erica Eriksson

Directions to most classrooms can be found at [www.kth.se/places](http://www.kth.se/places)