



Försättsblad Prov Original

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| Kurskod | Provkod | Tentamensdatum |
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| Kursnamn | Miljöteknik AV, Energi- och materialflödesanalys i byggd... | |
| Provnamn | Tentamen | |
| Ort | Östersund | |
| Termin | | |
| Ämne | | |



Course name:

Energy and material flow analysis in the built environment (MÖ016A), 7.5 ECTS

Duration:

5 hours

Support:

Language dictionaries

Examiner:

Itai Danielski

Phone:

010 1428716 (Itai Danielski)

Your handwriting should be clear and understandable.

Unclear handwriting may cause loss of points.

Don't forget

- **Write your personal code**
- **Register the question number in the answer paper sheets**
- **Submit this question sheet together with your answer paper sheet**

The maximum score for this examination is **100p** and minimum score to pass is **50p**. Your final score for this course will be the sum of scores from this exam and assignment evaluations.

Good Luck!

Question sheet

Part A: Explain 7 of the following terms:

5p X 8 = 40p

- 1) Dynamic modelling
- 2) Time factor
- 3) Specific heat capacity
- 4) Energy carriers
- 5) Industrial symbiosis
- 6) High heating value / Low heating value
- 7) Thermal mass
- 8) Temperature
- 9) Emissivity
- 10) Exergy

Part B: Open questions

6p X 4 = 24p

- 11) The energy efficiency of each of the following pairs need to be modelled and compared. Define the best functional unit that should be used for comparison.
 - a. A traditional light bulb - a compact fluorescent lamp
 - b. Traveling by car - Traveling by train
 - c. Heating an apartment by heat pump – by resistance heaters
 - d. CST power plant - NGCC power plant

- 12) When do we use allocation in system analysis? What type of allocation can we use? What is the disadvantage in using allocation? And what could we use instead?

- 13) Explain the differences between Primary energy, Final energy and Embodied energy.

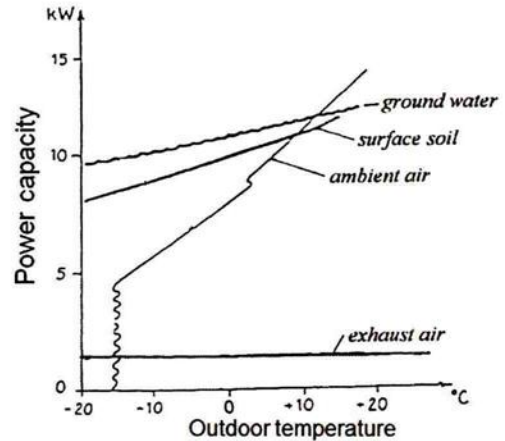
- 14) Explain the concepts bottom-up and top-down modelling approaches and the differences between them?

Part C: Multiple answer questions.

4p X 5 = 20p

!!! Notice: More than one answer is possible

15) The figure to the right illustrates four different heat pumps. Order the different heat-pumps by the sensitivity of their coefficient of performance (COP) to the outdoor conditions, from high to low.



- a. ambient
- b. surface
- c. ground
- d. air

16) Thermal conductivity of specific a material depends on:

- a. Heat transfer coefficient
- b. Temperature
- c. Pressure
- d. Material dimensions

17) Indoor thermal comfort depends on:

- a. Building design
- b. Metabolism
- c. Conduction
- d. Relative humidity

18) Sensitive analysis is used for:

- e. Evaluate policies and help to make decisions
- f. To test the robustness of the results of a model
- g. Test different assumptions
- h. To optimize the modelled system

19) Which of the following are policies for improve energy efficiency?

- a. Energy efficiency standards.
- b. Energy efficiency labelling.
- c. Energy efficiency measures.
- d. Energy efficiency obligations.

Part D: Analysis

16p X 1 = 16p

20) The upper figure below represents the heat demand load curve for a residential building before and after applying energy efficiency measures. The building is connected to the local district heating. The lower figure represents the heat supply load curve of the local district heating.

fluegas
 Which of the heat production technologies are mostly effected by the implementation of the energy efficiency measures in the building, in energy quantity? In power? *Boiler*

What will be the effect on heat production if an air-to-air heat-pump will be installed in the building as a base load heat supply in the building in addition to the district heating? Consider that the efficiency of air-to-air heat-pump (COP) are sensitive to outdoor temperature.

From a system perspective, would you recommend installing air-to-air heat-pump? Provide argumentation for your answer.

