



Summary

MOTIVATION

Our goal is to actively engage students in problem solving tutorials. This requires the students to solve problems and answer questions rather than passively watching the instructors. In addition to the improved learning, better insights into students' understanding are also expected. Given the size of the course, about 100 participants, another requirement is not to increase the work load for the instructors.

METHOD

A new learning management system (LMS) Studium is being introduced at Uppsala University. We have investigated possibilities for auto-correcting assignments, feedback options, and performance tracking in Studium. The work was done in frame of the course Electric Measurement Techniques.

OUTCOMES

- Studium is a great system with many advantages over Studentportalen.
- Self-correcting tests provide continuous formative assessment as well as instantaneous feedback to the students.
- Significant start-up effort is required in Studium, though reusing the material is easy.

CHALLENGES

- Difficult to implement mobile compatible test for use during classes, other student-response systems easier to use.
- The current status of Studium at UU remains unclear.
- Information overflow for instructors is possible.

Test design

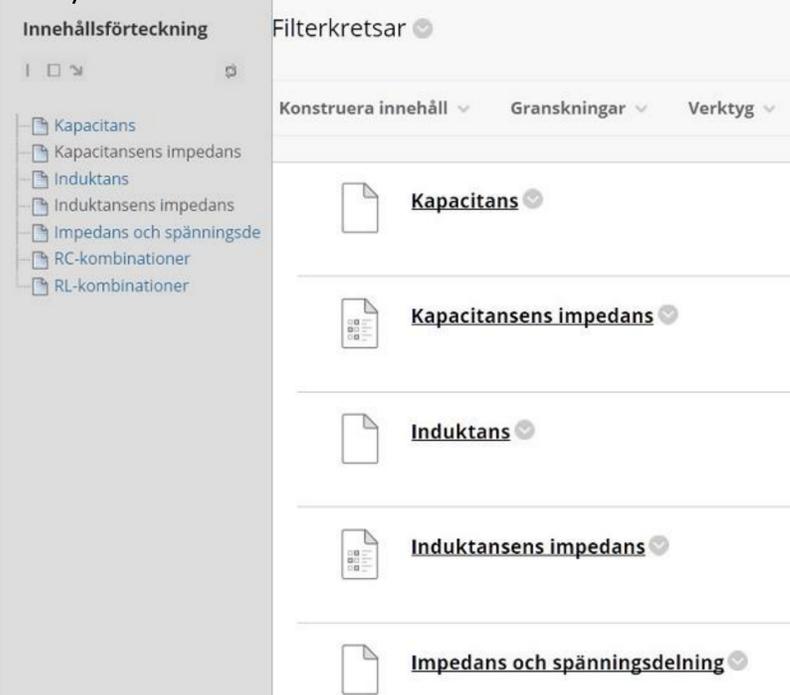
Questions pools: each pool is related to one topic, questions can be used in a number of tests

Test: One or more questions, questions are either fixed or randomly selected from a specific pool or according to a criteria

Automated evaluation and feedback: Different feedback on correct/wrong answer, adjustable level of feedback

Results statistics: various degree of detail is available to instructors

An example of a course module. Tests are placed between study blocks.



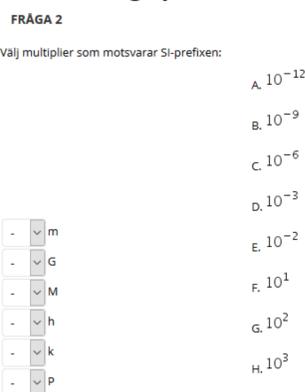
The screenshot shows a course module titled "Filterkretsar" with a table of contents on the left and a list of test blocks on the right. The table of contents includes: Kapacitans, Kapacitansens impedans, Induktans, Induktansens impedans, Impedans och spänningsdelning, RC-kombinationer, and RL-kombinationer. The test blocks on the right are: Kapacitans, Kapacitansens impedans, Induktans, Induktansens impedans, and Impedans och spänningsdelning.

Question types

We have used the following questions types:

- Calculated formula (Beräkningsfråga)
- Multiple choice (Flervalsfråga)
- Matching (Para ihop-fråga)
- Multiple blanks (Flersvarsfråga)
- Hot spot

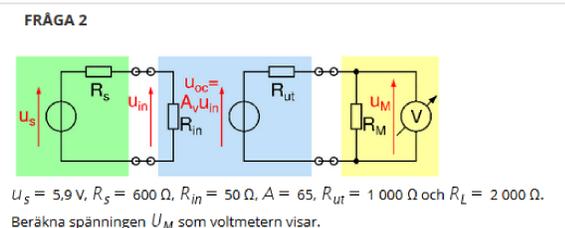
Matching question



The screenshot shows a matching question titled "FRÅGA 2" asking to select multipliers for SI prefixes. The options are: A. 10^{-12} , B. 10^{-9} , C. 10^{-6} , D. 10^{-3} , E. 10^{-2} , F. 10^1 , G. 10^2 , H. 10^3 , I. 10^6 , J. 10^9 , K. 10^{12} , L. 10^{15} . The user has selected 'm', 'G', 'M', 'h', 'k', and 'P'.

Several answers selected from a list of suggestions.

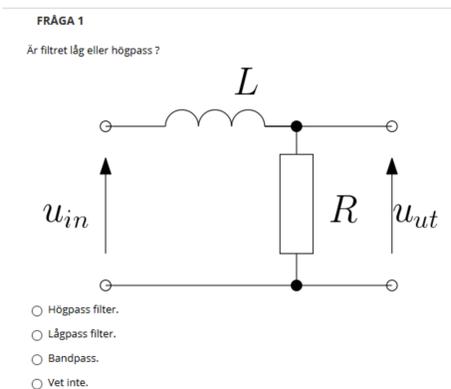
Calculated formula question



The screenshot shows a calculated formula question titled "FRÅGA 2" with a circuit diagram. The circuit consists of a voltage source U_s in series with a resistor R_s , followed by a parallel combination of a resistor R_{in} and a dependent current source $A \cdot U_{in}$. This is followed by a resistor R_{ut} in series with a parallel combination of a resistor R_M and a voltmeter U_M . The question asks to calculate the voltage U_M shown on the voltmeter. The given values are: $U_s = 5,9 \text{ V}$, $R_s = 600 \Omega$, $R_{in} = 50 \Omega$, $A = 65$, $R_{ut} = 1\,000 \Omega$ and $R_L = 2\,000 \Omega$.

The answer is a numerical value calculated from values generated by the system.

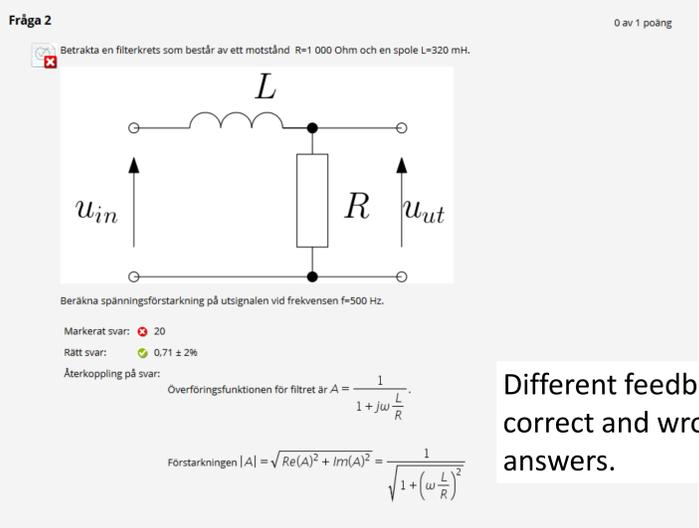
Multiple choice question



The screenshot shows a multiple choice question titled "FRÅGA 1" asking if a filter is low-pass or high-pass. The circuit diagram shows an inductor L in series with a resistor R in parallel. The input voltage is u_{in} and the output voltage is u_{ut} . The options are: Högpäss filter, Lågpäss filter, Bandpass, and Vet inte.

An answer selected from a list.

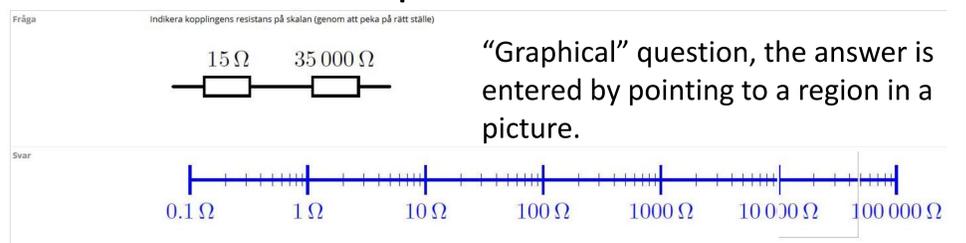
Feedback



The screenshot shows a feedback screen for a question titled "Fråga 2" with a score of 0 out of 1 point. The question asks to calculate the voltage gain A of a filter circuit at $f = 500 \text{ Hz}$. The circuit diagram is the same as in the multiple choice question. The user's answer is 20, and the correct answer is $0,71 \pm 2\%$. The feedback text says: "Återkoppling på svar: Överföringsfunktionen för filtret är $A = \frac{1}{1 + j\omega \frac{L}{R}}$. Förstärkningen $|A| = \sqrt{\text{Re}(A)^2 + \text{Im}(A)^2} = \frac{1}{\sqrt{1 + (\omega \frac{L}{R})^2}}$ ".

Different feedback on correct and wrong answers.

Calculated formula question



The screenshot shows a graphical calculated formula question titled "Fråga" asking to indicate the connection resistance on a scale. The circuit diagram shows two resistors in series: 15Ω and $35\,000 \Omega$. The answer scale is logarithmic, ranging from $0,1 \Omega$ to $100\,000 \Omega$. The user has indicated the correct region on the scale.

"Graphical" question, the answer is entered by pointing to a region in a picture.

Acknowledgement

- TUFF Teknisk-naturvetenskapliga fakultetens universitetspedagogiska förnyelsefond supported this work.
- Blackboard provide CourseSites, a free version of Studium, that was used.