Course memo 2026

The latest news can be found on Canvas (canvas.kth.se). It is also possible to contact the involved teachers:

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Assistance with administrative matters, such as course and exam registration, is managed by the student service desk:

- **Web**: KTH | EECS | Contact
  https://www.kth.se/en/eecs/kontakt
- **Service Center Borggården:** Lindstedtsvägen 3, floor 4
  (open Mo-Fr 9:00–12:00, 12:45–15:00)
- **Service Center Q:** Malvinas väg 10, entrance hall
  (open Mo-Fr 9:00–12:00, 13:00–15:00)

Learning Outcomes

The course provides an introduction to electricity markets and electricity pricing. The course also includes models and methods to simulate electricity markets focusing on carbon dioxide emissions.

To pass the course, the students should show that they are able to

- explain how the balance between generation and consumption is maintained in an electric power system, calculate how the frequency is affected by various events in the power system and design the frequency control so that there are sufficient margins in the power system,
- describe the principles of how electricity markets can be designed including regulatory framework to limit carbon dioxide emissions from electricity generation and to promote carbon dioxide free electricity generation,
- perform rough estimations of electricity prices as well as analyse factors that have a large importance for the electricity pricing and carbon dioxide emissions, and to indicate how these factors affect for example producers and consumers,
- apply Monte Carlo simulation to simulate an electricity market and use the simulation results to analyse the consequences of different measures,
- give a short oral presentation of the solution to a problem in electricity pricing and emissions.

Course Registration

In order to access the course on Canvas you need to be registered on the course. Most students can register themselves through their personal KTH menu. Contact student service if there is any problem.

Learning Activities

In order to fulfil the learning objectives of the course, students will have to put some effort into their studies. You can to a large extent decide yourself how to organise your studies, but it is of course important that you plan your work so that you can complete the examination (see below) on the available

Table 1 Schedule for the lectures.

Lecture	Time and place	Topics	Exercise book
Introduction	Monday 26 October, 10–12, V1	Course organisation.	–
L1	Tuesday 27 October, 13–15, H1	Introduction to frequency control. Primary control.	–
L2	Wednesday 28 October, 15–17, H1	Limitations in primary control.	2
L3	Thursday 29 October, 10–12, H1	Secondary and tertiary control. Presentation techniques.	2
L4	Thursday 29 October, 13–15, H1	Players in the electricity market. Ahead trading.	2
L5	Friday 30 October, 10–12, H1	Real-time trading. Post trading.	3
L6	Monday 2 November, 13–15, H1	Grid tariffs.	3
Reserve	Tuesday 3 November, 10–12, H1		3
L7	Friday 6 November, 10–12, H1	Ideal markets. Simple price model.	4
L8	Monday 9 November, 15–17, H1	Impact of non-ideal conditions.	4
L9	Tuesday 10 November, 8–10, H1	Introduction to CO_2 emissions.	5
L10	Wednesday 11 November, 15–17, H1	Internalisation of external costs.	5
L11	Thursday 12 November, 10–12, H1	Subsidies.	5
L12	Thursday 12 November, 13–15, H1	Consumer response.	5
Reserve	Friday 13 November, 10–12, H1		–
L13	Wednesday 18 November, 13–15, H1	Random variables. Simulation of electricity markets.	9
L14	Thursday 19 November, 10–12, H1	Scenario generation.	9
L15	Thursday 19 November, 13–15, H1	Simple sampling.	9
L16	Friday 20 November, 10–12, H1	Correlated sampling. Project assignments.	9
Reserve	Monday 23 November, 15–17, H1		–

times.

The following learning activities are offered in the course:

- **Lectures.** The lectures present the most important theory as well as practical examples. There are also ready-made lecture notes for most of the lectures as well as recorded lectures.[1] Lecture notes and recorded lectures are found in Canvas.

  Please notice that lectures marked "Reserve" will not be used unless another occasion has been cancelled. Information about changes in the schedule will be announced in Canvas.

- **Lecture assignments.** The lecture assignments are small problems that are solved during the lectures. The idea behind these assignments are that you should get an opportunity to master the basic definitions and calculation methods that are required to pass the course. What is important is therefore not to answer these questions correctly, but to learn something from them (preferably in cooperation with your fellow students). The lecture assignments are therefore not part of the examination in the course.

- **Self-study.** The most important literature in this course are the lecture slides. In addition to the slides, there is also some additional reading and an exercise book available in Canvas.

1. Please notice that the recorded lectures are not updated annually and there can therefore be minor differences between the lecture notes and the recorded lectures.

Support for Students with Disabilities

Students at KTH with a permanent disability can get support during studies from Funka (see https://www.kth.se/en/student/stod/studier/funktionsnedsattning/funka). Please inform the course coordinator if you have special needs not related to the written exam, and show your certificate from Funka.

- Support measures under code R (i.e. adjustments related to space, time, and physical circumstances, e.g. longer writing time) are always granted.
- Support measures under code P (pedagogical measures) may be granted or rejected by the examiner after you have applied for this in accordance with KTH rules. Support measures under code P are usually always granted for courses given at EECS.

Examination

The examination of this course is divided in multiple parts: seminars (SEM1), written exam (TEN1) and project assignments (PRO1 and PRO2). Students are required to have a Pass grade on the seminars and the exam for the final grade E. Students who have passed the seminars and exam and also pass one of the two optional project assignments will receive the highest grade from the project assignments as the final grade.

In short, all students will need to participate in the seminars, but there are several possibilities to catch up if you would miss a seminar. All students need to pass the written exam, but the written exam can be replaced by an alternative examination (a combination of a quiz and participating in the project assignments). The project assignments are voluntary, but are necessary for a final grade higher than E and are also part of the alternative examination. An overview the examination activities in the course is given in table 2. Details about each activity are explained in the following subsections.

Grading criteria

The examination includes two types of problems:

- **Basic problems.** The problem text is relatively short and there is a direct question. The problems may include calculations, short theoretical questions and multiple choice questions.
- **Advanced problems.** The problem text is relatively long. The student will have to identify the problem from the text, choose an appropriate solution method and be able to discuss the conclusion of the results.

The grading criteria are shown in table 3. Familiar problems refers to problems that have been explained in lectures, course literature or seminars. New problems refers to problems that can be solved using methods explained in the course, but which have not yet appeared in the course. Moreover, new advanced problem may require that the students have to adjust models and methods in order to apply them on the problem and that they can see the connection between different topics of the course, for example by running a Monte Carlo simulation to study the impact on CO_2 emissions. Advanced problems may also intentionally be formulated so that there are more than one possible solution; thus, not only the solution itself but also the motivation for the chosen solution will be evaluated.

Seminars

There will be three seminars during the course. There is one problem (with multiple questions) for each seminar. The questions include a mix of familiar basic and advanced problems on frequency control, pricing and emissions as well as Monte Carlo simulation.

The total score for the seminars is 50 points and you need at least 45 points to pass. The points are valid until the re-exam. If you have not completed the seminars by then, you will have to redo them from the beginning next academic year. Hence, if you are at the end your studies and want to get your degree later this academic year then it is important that you plan your studies so that you can complete the seminars in time.

The rules for the seminars are as follows:

- **Group.** The problems may be solved in groups of up to four students. Students may choose themselves who to work with and you do not need to register your group in Canvas.

Table 2 Examination activities.

Activity	Problem	Registration	Time	Where
Quiz	Electricity markets	None	Wednesday 4 November 8–10	Canvas
Seminar 1	Frequency control	Canvas calendar	4–5 November	Zoom
Seminar 2	Pricing and emissions	Canvas calendar	17–18 November	Zoom
Seminar 3	Monte Carlo simulation	Canvas calendar	24 November	Zoom
Project assignment I	Frequency control, pricing and emissions, Monte Carlo simulation)	Canvas calendar	Published: Wednesday 25 November Deadline: Wednesday 2 December, 8:00 Presentations: Week 50 and 51	Canvas and Zoom
Repetition seminar	Frequency control, pricing and emissions, Monte Carlo simulation)	Canvas calendar	December 2026	Zoom
Quiz	Electricity markets	None	Wednesday 9 December 8–10	Canvas
Project assignment II	Frequency control, pricing and emissions, Monte Carlo simulation)	Canvas calendar	Published: Friday 11 December Deadline: Friday 18 December, 8:00 Presentations: Week 52 and 2	Canvas and Zoom
Repetition seminar	Frequency control, pricing and emissions, Monte Carlo simulation)	Canvas calendar	January 2027	Zoom
Written exam	All	Ladok	Monday 11 January, 14–17	Classroom
Repetition seminar	Frequency control, pricing and emissions, Monte Carlo simulation)	Canvas calendar	April 2027	Zoom
Written exam	All	Ladok	April 2027	Classroom
Zoom links can be found in Canvas. Classrooms for exams are found in the official KTH schedule. You will also get a notification where to go for the exam after registration.				

Table 3 Grading criteria.

Grade	Requirement	Examination
E	• Ability to determine if statements on electricity markets are true or false. • Ability to solve basic problems on frequency control, pricing and emissions as well as Monte Carlo simulation. • Ability to give a short oral presentation of problems in electricity pricing and emissions and to discuss the solutions with other students.	Quiz or exam Project assignments or exam Seminars
D	As for E, as well as *ability to solve advanced but **familiar** problems* on frequency control, pricing and emissions as well as Monte Carlo simulation.	Project assignment I (Project assignment II)
C	As for E, as well as ***very good** ability to solve advanced but **familiar** problems* on frequency control, pricing and emissions as well as Monte Carlo simulation.	Project assignment I (Project assignment II)
B	As for E, as well as *ability to solve **new** advanced problems* on frequency control, pricing and emissions as well as Monte Carlo simulation.	Project assignment II
A	As for E, as well as ***very good** ability to solve **new** advanced problems* on frequency control, pricing and emissions as well as Monte Carlo simulation.	Project assignment II

- **Solution.** The problems should be solved according to the EECS code of honour (see https://www.kth.se/en/eecs/utbildning/hederskodex/inledning). Please notice that each group should solve the assignment on their own and it is not allowed to cooperate with anyone else. However, it is allowed to ask teachers, other students or to use generative AI to get advice on how to solve a small part of a problem (for example to troubleshoot code). It is also allowed to compare numerical results with other groups.
- **Preparation.** The solution should be explained in slides. The slides do not need to be submitted in advance. The front page of the solution should state the name of all group members, the course code (EG2230) and the date when the report was prepared. The text, figures and tables in the slides must include sufficient detail that the argument and calculations can be easily followed also for someone who is not attending the presentation. The principles of calculations that are performed in Matlab or any other software must be described in the slides.
- **Presentation.** The solutions are presented in seminars. The schedule for the seminars are found in Canvas. Repetition seminars will be added according to the need after the completion of the ordinary seminars. The number of seats is limited in each seminar; therefore, each student has to sign up for the seminars in advance using the calendar function in Canvas. All group members do not need to attend the same seminar.
- **Score.** Students get points for the questions which they have indicated in the attendance list that they are prepared to present in the seminar. It should be noted that the presented solution does not have to be completely correct. To pass a presentation it is sufficient that the student shows that he or she is able to discuss the solution with other students and the teaching assistant. This means that the student must be able to explain why he or she decided to solve the problem in a particular way and to explain all details in the solution, such as for example how input values have been chosen or why a particular formula has been used. The student should also be able to compare his or her solution to alternative solution methods suggested by the other participants and discuss which method that should be used.

At the beginning of the seminar each student should state in the attendance list which questions they are ready to present. It is the responsibility of the student to make sure that their participation in the seminar is recorded in the attendance list organised by the teaching assistant. The ordinary seminars comprises a given selection of questions, as shown in the schedule above. For each question, the course assistant chooses[2] which student that is giving their presentation. If there is time left, several students may present the same question. The repetition occasions can be used to present those questions that the student has been skipped earlier or have failed to present. For each participating student, the course assistant then chooses[3] one or more questions to present.

If a student has passed all presentations during a seminar (or if the student is not selected to present) then points will be rewarded for all questions that the student was prepared to present. However, if a student fails at least one oral presentation, no points at all will be rewarded for this seminar, regardless of which other questions that the student have been prepared to present!

Exam

The exam can be completed either by alternative examination after the lecture part of the course or by participating in a written exam. Please notice that if you are about to finalise your studies and want to get your degree then it is important that you plan your studies so that you can pass the exam during the course (quiz and project assignments) or in one of the written exams that are offered in an academic year. However, according to KTH Guideline on course syllabus, grading system and examination at education on all cycles (section 7.2)[4] students have the right to demand an extra exam if there is a proper cause; in short, it is required that you have failed the last two exams and that this course is the only course that is left before you can get your degree. If you are granted an extra exam, you will agree upon a date for the exam with the examiner. If you for some reason cannot prepare to the extent that you would desire (for example due to a new employment) then it is important that you contact the examiner and reschedule the exam, because if you fail an exam that you have requested yourself then you will have to wait for the next scheduled exam in order to make another attempt.

2. The selection is done almost, but not quite entirely, randomly.
3. This selection is also done almost, but not quite entirely, randomly.
4. Available at https://intra.kth.se/en/styrning/styrdokument/regler/utbildning.

Alternative examination

Students can receive the grade P for the written exam by participating in alternative examination when the lecture part of the course is finished. The alternative examination consists of a quiz in combination with the project assignments. The quiz is available from the course room in Canvas and covers a mix of familiar and new basic questions on electricity markets. The project assignments are the same as the assignments for higher grades (see below). The following requirements need to be fulfilled in order to pass the alternative examination:

- The quiz is open during two hours at two occasions (see Canvas). You can choose yourself when to take the quiz, but keep in mind that you only have three attempts to pass during each occasion. You have 15 minutes for each attempt and you need to get every answer correct in one attempt in order to pass the quiz. You are not allowed to discuss the questions with anyone else during the quiz, but you are allowed to look in the lecture notes and your own personal notes. You can also use a calculator.
- You need to receive a minimum score on each topic in the project assignments (see table 4). It does not matter if you received the score on a problem from project assignment I or II.

If students fulfil all requirements above they will receive the grade P for the written exam, i.e., the alternative examination will replace the written exam. Please notice that the grading scale for the alternative examination is pass or fail—there is no partial completion or possibility to write complementary tests or any other extra assignments.

Table 4 Required score for each project assignment to replace written exam.

Topic	Problem	Required score
Frequency control	1	6
Pricing and emissions	2	14
Monte Carlo simulation	3	10

Written exam

In order to attend a written exam, students must register in advance. Please contact student service if you have difficulties registering. The written exam is offered twice every academic year: during the exam period 2 and during the re-exam period 2.

A written exam is three hours long and consists of a mix of familiar and new basic problems on frequency control, electricity markets, pricing and emissions as well as Monte Carlo simulation. Notice that each written exam is an independent test and there will be no bonus points in the written exam, i.e., students will need to answer all questions in the exam and get at least 48 points (out of 60) to pass. Examinees who have failed the exam but are close to the requirement for passing (i.e., 46 or 47 points) may write a complementary test. If the result of this test is approved, the student will pass the exam. The date of the extra test is decided by the course coordinator after consulting the concerned students. However, the student must notify his or her intention to write the complementary test no later than one month after the exam.

The following aids are allowed at the written exams and complementary tests:

- Calculator without information relevant to the course.
- One **handwritten**, **single-sided** A4-page with **your own** notes (original, not a copy), which should be handed in together with the exam.

Project assignment I

The first project assignment is voluntary and can yield the grades C or D if completed successfully. The assignment can also be part of the alternative examination and replace the written exam (see above). The problems are familiar advanced problems on frequency control, electricity pricing and emissions as well as Monte Carlo simulation.

The total score of project assignment I is 50. Students who receive at least 43 points will get the grade C and students who receive at least 35 points will receive the grade D.

The rules for project assignment I are as follows:

- **Group.** The problems may be solved individually or by a group of two students. Students may choose themselves who to work with, but students are requested to set up their group in Canvas using the "People" section.
- **Solution.** The problems should be solved according to the EECS code of honour (see https://www.kth.se/en/eecs/utbildning/hederskodex/inledning). Please notice that each group should solve the assignment on their own and it is not allowed to cooperate with anyone else. However, it is allowed to ask teachers, other students or to use generative AI to get advice on how to solve a small part of a problem (for example to troubleshoot code). It is also allowed to compare numerical results with other groups. Such assistance must be indicated in the solution in accordance to rule 2 of the EECS code of honour.
- **Preparation.** The solution should be explained in slides. The slides should be uploaded in Canvas using the "Assignments" section. There are two Canvas assignments for this project assignment: one for the slides themselves and one for additional program code.

  The front page of the solution should state the name of all group members, the course code (EG2230) and the date when the report was prepared. The text, figures and tables in the slides must include sufficient detail that the argument and calculations can be easily followed *without an oral explanation*. The principles of calculations that are performed in Matlab or any other software must be described in the slides.
- **Defence.** Each group member must orally defend the group's solution. Sign up for a defence time using the calendar function in Canvas. Notice that you sign up as a group, but that each group member will have to explain the solution individually (while the other group member is waiting).
- **Score.** The solutions will be marked in Canvas. There will be a score reduction for errors in the presented solutions. However, students will not receive any score for a problem if they did not attend the defence or if they cannot respond well enough to the course assistant's questions about how they have solved the problem.

Project assignment II

The second project assignment is voluntary and can yield the grades A to D if completed successfully. The total score of the project assignment II is 50. Students who receive at least 43 points will get the grade A and students who receive at least 35 points will receive the grade B. Students who do not get at least 35 points in project assignment II can get the grades C or D by combining the results from both project assignments. For each problem, the student may count the best score from project assignments I and II respectively. If this sum is at least 43 points then the student will get the grade C and students who receive at least 35 points will receive the grade D.

The rules for project assignment II are as follows:

- **Group.** The problems may be solved individually or by a group of two students. Students may choose themselves who to work with, but students are requested to set up their group in Canvas using the "People" section.
- **Solution.** The problems should be solved according to the EECS code of honour (see https://www.kth.se/en/eecs/utbildning/hederskodex/inledning). Please notice that each group should solve the assignment on their own and it is not allowed to cooperate with anyone else. However, it is allowed to ask teachers, other students or to use generative AI to get advice on how to solve a small part of a problem (for example to troubleshoot code). It is also allowed to compare numerical results with other groups. Such assistance must be indicated in the solution in accordance to rule 2 of the EECS code of honour.
- **Preparation.** The solution should be explained in slides. The slides should be uploaded in Canvas using the "Assignments" section. There are two Canvas assignments for this project assignment: one for the slides themselves and one for additional program code.

  The front page of the solution should state the name of all group members, the course code (EG2230) and the date when the report was prepared. The text, figures and tables in the slides must include sufficient detail that the argument and calculations can be easily followed *without an oral explanation*. The principles of calculations that are performed in Matlab or any other software must be described in the slides.
- **Defence.** Each group member must orally defend the group's solution. Sign up for a defence

time using the calendar function in Canvas. Notice that you sign up as a group, but that each group member will have to explain the solution individually (while the other group member is waiting).

- **Score.** The solutions will be marked in Canvas. There will be a score reduction for errors in the presented solutions. However, students will not receive any score for a problem if they did not attend the defence or if they cannot respond well enough to the course assistant's questions about how they have solved the problem.

Course Evaluation Committee

To evaluate and improve the course, we need a few students who are willing to participate in the course evaluation committee. The committee is meeting shortly after the ordinary exam. Students who are interested in participating can contact the course coordinator by e-mail or in connection to a lecture.