EG2100 Power System Analysis (6 cr.)

Course Memo

HT21

Content and learning objectives

- **Course content**

Fundamental principles for power system analysis, methods for analysis and design of power networks in steady state under symmetrical as well as unsymmetrical conditions.

- **Learning objectives**

There are two intended learning outcomes (ILOs). In order to successfully complete this course, the students should be able to:

ILO1. create mathematical models based on which to analyze and perform calculations

a) under symmetrical conditions,

b) under unsymmetrical conditions,

c) for load flow.

ILO2. numerically perform ILO1 by using MATLAB, and present and discuss obtained numerical results.

- **Course pedagogical structure**

The course includes lectures, project work hours, and examination. During the project work hours, the teaching assistants will be available to assist the students with the projects. **Note that teaching assistants will only be available during the project work hours.**

- **Links to degree objectives**

Electrical Engineering, Second cycle

This course deals with basic models and methods that are used in static analysis of electric power systems. These models and methods are fairly general and can be applied to a power system of any scale ranging from a small-scale distribution grid to a national transmission network.

- **Language of instruction**

English

- **Detailed schedule**

In the table below, the following acronyms are used.

- **LE** stands for lecture
- **TA** denotes project work hours (**NB! Not a lecture**), responsible teaching assistant will be available.

week	Day	Date	Time		Activity	Location	Content
w35	Wednesday	2021-09-01	15:00	17:00	LE	Zoom	Intro, Ch 1-4
w35	Friday	2021-09-03	15:00	17:00	LE	Pre-recorded	Ch 5-6
w36	Wednesday	2021-09-08	15:00	17:00	LE	Zoom, pre-recorded	Ch 5-6
w36	Friday	2021-09-10	15:00	17:00	TA	Zoom	S1
w37	Monday	2021-09-13	15:00	17:00	LE	Pre-recorded	Ch 6
w37	Wednesday	2021-09-15	15:00	17:00	LE	Zoom, pre-recorded,	Ch 6
w38	Wednesday	2021-09-22	15:00	17:00	TA	Zoom	S2
w38	Friday	2021-09-24	15:00	17:00	TA	Zoom	S2
w39	Wednesday	2021-09-29	15:00	17:00	TA	Zoom	S2
w39	Friday	2021-10-01	15:00	17:00	LE	Zoom	Examples/S1-S2
w40	Wednesday	2021-10-06	15:00	17:00	LE	Zoom	Ch 7
w40	Friday	2021-10-08	15:00	17:00	TA	Zoom	S2
w41	Tuesday	2021-10-12	10:00	12:00	TA	Zoom	LF
w41	Friday	2021-10-15	15:00	17:00	LE	Zoom	Ch 7
w44	Wednesday	2021-11-03	15:00	17:00	TA	Zoom	LF
w44	Friday	2021-11-05	15:00	17:00	LE	Zoom	Examples/LF
w45	Wednesday	2021-11-10	15:00	17:00	TA	Zoom	LF
w45	Friday	2021-11-12	15:00	17:00	TA	Zoom	LF
w46	Wednesday	2021-11-17	15:00	17:00	TA	Zoom	LF
w46	Friday	2021-11-19	15:00	17:00	LE	Zoom	Ch 8
w47	Wednesday	2021-11-24	15:00	17:00	LE	Zoom	Ch 8
w47	Friday	2021-11-26	15:00	17:00	LE	Zoom	Ch 8
w48	Wednesday	2021-12-01	15:00	17:00	TA	Zoom	S3
w48	Friday	2021-12-03	15:00	17:00	TA	Zoom	S3
w49	Wednesday	2021-12-08	15:00	17:00	TA	Zoom	S3
w49	Friday	2021-12-10	15:00	17:00	TA	Zoom	S3
w50	Wednesday	2021-12-15	15:00	17:00	LE	Zoom	Examples/S3

w50	Friday	2021-12-17	15:00	17:00	TA	Zoom	S3
w3	Monday	2022-01-17	**08:00**	**13:00**		Zoom	**Oral Explanation (OE)**

The assignments must be submitted no later than 12.00 (noon) on the following submission dates:

Assignment S1	Thursday, September 16, 2021
Assignment S2	Monday, October 11, 2021
Assignment LF	Tuesday, November 23, 2021
Assignment S3	Monday, December 20, 2021

Course literature and preparations

- **Special authorization**

Prerequisites:

- SF1624 Algebra and geometry (or equivalent)
- SF1625 Calculus in one variable (or equivalent)
- SF1626 Calculus in several variables (or equivalent)
- SF1519 Numerical methods and basic programming or
- SF1546 Numerical methods, basic course or
- EL1150 Introductory Matlab course (or equivalent)
- EJ1200 Electric power systems (or equivalent)
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- **Recommended previous knowledge**

Knowledge in algebra and geometry, 7.5 higher education credits, equivalent to completed course SF1624.

Knowledge in one variable calculus, 7.5 higher education credits, equivalent to completed course SF1625.

Knowledge in multivariable analysis, 7.5 higher education credits, equivalent to completed course SF1626.

Knowledge in Matlab, 1.5 higher education credits, equivalent completed course SF1519/SF1546/EL1150.

Knowledge in Electric Power Systems, 6 higher education credits, equivalent completed course EJ1200.8

Active participation in a course offering where the final examination is not yet reported in LADOK is considered equivalent to completion of the course. Registering for a course is counted as active participation. The term 'final examination' encompasses both the regular examination and the first re-examination.

- **Course literature**

Lennart Söder & Mehrdad Ghandhari, ***"Static Analysis of Power System***", available in Canvas.

- **Disability**

If you have a disability, you may receive support from Funka, KTH's coordinator for students with disabilities, see https://www.kth.se/en/student/studentliv/funktionsnedsattning.

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) are generally granted by the examiner.

- 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. Normally, support measures under code P will be granted.

Examination and completion

- **Rating scale**

A, B, C, D, E, FX, F

- **Examination**

The course examination consists of

- a project with four assignments, namely **S1**, **S2**, **S3** and **LF** which are presented in a written report, respectively, and
- an individual oral explanation (**OE**). The **OE** can be performed only if all assignments have been passed. During the **OE**, the course staff will go through your reports and ask you to explain/motivate your answers in the reports. **No PowerPoint presentation is required.**

A unique identification number, called **A-number**, will be given to each student. This **A-number** will be used in the assignments.

You receive your **A-number** by sending an email to qianwenx@kth.se. Write 'A-number' in the subject of your email, and **your name**, **your personal number** and **your email address** in the body of your message.

The A-numbers will be sent only to students who have been registered for the course.

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

- **Examiner**

Qianwen Xu, qianwenx@kth.se

- **Ethical approach**

  - In any assessment, every student shall honestly disclose any help received and sources used.
  - In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution

- **Goal-related grading criteria / assessment criteria**

The table below shows mapping of ILOs to the course assessment.

	S1	**S2**	**S3**	**LF**
ILO1 a)	X	X		
ILO1 b)			X	
ILO1 c)				X
ILO2	X	X	X	X

- **Examination details**

The grades used for assessing the criteria are

- **P/F** for **S1** and **OE**,
- **0 p., 1 p., 3 p.** and **5 p.** for **S2**, **S3** and **LF**.

For grade **P**, the following criteria will be applied to **S1** and **OE**.

• **S1:** if

- the given instructions for the assignments are fully followed,
- all introduced variables and quantities are clearly defined,
- correct answers to some parts of the questions are given.

• **OE**: if the oral explanations demonstrate the ability to meet ILO1.

For **S2**, **S3** and **LF**, the following grading criteria will be applied, respectively.

	1 p.	3 p.	5 p.	0 p.
S2 **S3** **LF**	• Solutions demonstrate a sufficient ability to meet ILO1. • Introduced variables and quantities are clearly defined. • Correct answers to some parts of the question. • The given instructions for the assignments are fully followed.	• Solutions demonstrate the ability to meet ILO1. • Introduced variables and quantities are clearly defined. • Correct answers to the most part of the question. • The given instructions for the assignments are fully followed.	• Solutions demonstrate the ability to meet ILO1. • Introduced variables and quantities are clearly defined, and the answers are well motivated. • Correct answers to all parts of the question. • The given instructions for the assignments are fully followed.	If at least **1 p.** is not earned

In order to successfully complete the course (6 cr.), the following necessary requirements (**NR**) must be met:
NR1. Grade **P** for **S1**.

NR2. At least **1 p.** for **S2**, **S3** and **LF**, respectively.

NR3. Grade **P** for **OE**. The **OE** can be performed if only **NR1** & **NR 2** are met.

The table below shows the course final passing grades **A-E** based on the earned points from **S2**, **S3** and **LF.**

Total earned points	Grade
15	**A**
11 or 13	**B**
9	**C**
7	**D**
3 or 5	**E**

The grade of **F** will be assigned to students who have not fulfilled all necessary requirements (NR).

Opportunity to complete the requirements via supplementary examination (FX)

If **NR1** is met, but not **NR2** for **only one** assignment (i.e. S2, S3 or LF, one of them is **0 p.**), the student will then be offered a new opportunity to revise the failed report and to resubmit it to Canvas by Jan 8, 2022. Once the resubmitted report is passed, the student will only earn **1 p.** for the resubmitted report.

If the resubmitted report is not passed, the ordinary **OE** cannot be performed and the report can be again revised and resubmitted for re-examination.

Re-examination

This is the last opportunity during this academic year for being able to fulfil all necessary requirements (NR) to successfully complete the course. Thus, the following reports can be submitted to Canvas by March 15, 2022.

- The already submitted failed reports. Once the reports are passed, the student will only earn **1 p.** for each passed report.
- The reports which were not submitted on the ordinary given dates. For the passed reports, the grading criteria will be applied.

Furthermore, those who did not attend (or failed) the ordinary **OE** can perform it (providing that **NR1** & **NR 2** are met) on the scheduled date for re-**OE** in April.

More information

- **Learning platform**

Canvas is an electronic communication platform we use in the course where you find course literature, lecture slides, assignments, schedule, etc. Canvas is also the platform where you electronically submit (upload) your reports.

- **The course is given by**

EECS/Electrical Engineering

- **Teacher**

Course staff

Course examiner and course responsible:	**Lecturers:**
Qianwen Xu qianwenx@kth.se phone: 08- 790 63 56	Lennart Söder lennart.soder@ee.kth.se phone: 08-790 8906
	Qianwen Xu qianwenx@kth.se phone: 08- 790 63 56

Teaching assistants:
Saeed Mohammadi saeedmoh@kth.se
Umbereen Sayyeda sayyeda@kth.se
Yizhou Lu

- **Communication with teachers**

Feel free to contact the teachers in connection with Canvas

- **Course evaluation and course analysis**

A course questionnaire will be sent out to the course participants at the end of the course. Also, the course responsible and TAs, in consultation with the students responsible for the course, will do a course analysis that is published on the course website

- **Extension**

EG2110 Power System Stability and Control