EIEN15 – Electric Power Systems

Course program

The course has lectures, exercises and laboratory exercises with preparatory computer exercises. The laboratory work with their preparations is compulsory. The course is based on Canvas, with the entry point given at the course website **www.iea.lth.se/eps/**. The single **Zoom link** used throughout the course is found in Canvas. Canvas access is given to all who sign up for the course. Alternatively, contact Olof.Samuelsson@iea.lth.se.

Material

The course uses the textbook *Power System Analysis and Design* by J. D. Glover, T. Overbye, M. Sarma, Cengage Learning, UK, 2016, 6th SI edition ISBN-13: 9781305636187. Buy it at KFS, adlibris, bokus or cdon. **5th edition also works**. The laboratory preparations (computer exercises) and the textbook use the PowerWorld Simulator. It runs under **Windows** and is available in the LTH computer rooms. You can also download it for free from http://www.powerworld.com/gloversarmaoverbye

Lectures and exercises

- Lectures are in **Zoom**.
- Exercises are in rom **M:IEA at KC** and simultaneously in **Zoom**.
- Computer exercises are in rooms **M:Ina1-2 at KC** and simultaneously in **Zoom**.
- Laboratory exercises are in **IEA lab7** in the M-building with limited group size.

w	Mon	Tue	Wed	Thu	Fri
1	-	10-12 L1	-	8-10 L2	8-10 E1
2	15-17 L3	8-10 E2	-	8-10 L4	8-10 E3
3	-	8-10 E4	10-12 L5	8-10 E5	8-10 CE1 10-12 CE1
4	-	-	10-12 L6	-	8-10 E6
5	13-15 L7	-	-	8-10 L8	8-10 E7
6	13-15 L9	-	-	8-10 CE2	8-10 CE2 13-15 E8
7	13-15 L10	-	-	8-10 L11	-
8	-	8-10 E9 10-12 E10	-	-	-

L=Lecture, E=Exercise, CE=Computer Exercise

Personnel

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Lecture program

	Content	Textbook reading
L1	**Power system components** (networks, lines, transformers, generators, power electronic converters)	(1.1-1.5), 2.1-2.6, 5.1-5.3, 3.1-3.2, 11.2, 11.7 (Type 4)
L2	**System representation** (single line diagram, network matrices Ybus and Zbus, per unit, Thévenin)	3.3-3.5
L3	**Symmetrical fault** (fault current, fuses and circuit breakers, relay protection, reliability, sectionalizing)	7.3-7.5, 10.1-10-12
L4	**Unsymmetrical faults** (sequence components, earthing, single line to ground fault, two-phase faults)	8.1-8.6, 9.1-9.4
L5	**Voltage** (AC voltage, voltage profile, reactive compensation, limit for DG)	5.4-5.7, 9.5
L6	**Load flow** (line flow, load flow problem, Newton-Raphson, DG reduces losses)	6.4, 6.6, 6.11
L7	**Synchronous generator** (generator controllers, load flow control, synchronization, fault current transient)	12.1-12.2, 7.1-7.2
L8	**Angle instability** (swing equation, Equal Area Criterion, modal analysis)	11.1-11.8
L9	**Power-frequency control** (inertial response, load sharing)	12.2-12.3
L10	**Guest lecture**	
L11	**Topics of your choice repeated**	

Exercise program

Material for the exercises is or will be made available in Canvas.

E1 Per unit, bus admittance matrix, bus impedance matrix, Thévenin
E2 Symmetrical fault, protection zones, protection coordination
E3 Sequence components, SLG-fault, LL-fault, LLG-fault
E4 SLG-fault, LL-fault, LLG-fault, earthing
E5 Voltages and angles, reactive shunt compensation
E6 Line transfer, load flow equations, Newton-Raphson, Jacobian, load flow control
E7 Equal Area Criterion, fault current transient
E8 Load sharing, small signal stability
E9 Last year's exam
E10 Q&A session

Laboratory exercises

The course includes two compulsory laboratory exercises in M:IEA Lab7 (**M-building**).

Lab1 Voltage and fault currents in power system networks
Lab2 The synchronous generator at steady state and transient operation

Laboratory exercises run in the weeks following the computer exercises. You sign up using a Doodle (or equivalent) distributed in the beginning of the course. For COVID19 reasons you will work alone at both labs. Material for the laboratory exercises, including

Safety instructions for laboratory work at IEA are available in Canvas. The **preparations are compulsory** and will be checked in the lab. The computer exercises in computer rooms aim to help students with the preparations but are not compulsory.

Study visit at transformer station in Lund

The visit will show substation equipment and protection at a transformer station near Delphi in Lund. Time, address, and more details will be announced later.

Exam

The compulsory written exam is **28 October at 14:00-19:00 in Kårhusets Gasquesal**.

Where are the rooms?

K M:Ina1-2 – Use entrance B (level 0) or D (level -1) of Kemicentrum. On level 0, Ina1 is in the Southeastern corridor and Ina2 is in the Northwestern corridor.

M:IEA Lab7 – Enter **M-building** from parking lot facing Sparta, use the door in front of you or the first to the left.

K M:IEA and IEA offices – Use entrance B (level 0) or D (level -1) of Kemicentrum. On level +2 M:IEA and IEA offices are in the eastern corridors.