



KTH Electrical Engineering

EG2040 Wind Power Systems Course Syllabus 2012

The latest news related to the course is announced on Bilda and the course webpage at the following address
<https://www.kth.se/social/course/EG2040/>.

It is also possible to contact the course staff:

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Staffan Engström	Ägir konsult
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Karin Hammarlund	Hammarlund consulting AB
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Objectives

The course Wind Power Systems aims at providing knowledge about the wide area of technology that is needed for persons working in the wind energy industry or related industry, such as generation or network companies.

At the end of the course you should be able to

- give some basic definitions (power curve, overall efficiency, Betz limit, stall and pitch regulation, etc.),

- understand basic concepts, such as power in the wind, vertical distribution of wind speeds, power production and efficiency of a wind turbine, energy yield of a wind turbine from a site,
- calculate energy yield of a wind turbine using actual wind speed measurements or approximate data,
- describe the main wind turbine design concepts, main differences, advantages, disadvantages,
- understand basic concepts from grid integration of wind turbines (voltage at the connection point, active, reactive power, strength of the grid, power quality of a wind turbine),
- describe some effects that wind power has on power system operation and grid investments,
- describe operation of hybrid systems (wind/diesel, wind/battery/diesel),
- describe effects that wind power has on environment,
- describe different economical support schemes for wind power.

In order to receive a higher grade (A-D), you will also need to show that you are able to

- derive the important formulas studied during the course (power in the wind, Betz limit, etc.),
- analyse and compare characteristics of different wind turbines,
- present some control possibilities of wind turbines,
- analyse wind conditions, and wind farm layout possibilities of the particular site,
- perform basic calculations and analysis for grid connection of a wind turbine,
- describe main aspects treated in the Grid Codes for connection of wind turbines and explain why those aspects are important.

Prerequisites

60 HEC (basic mechanics, basic physics, complex numbers, numerical methods), and documented proficiency in English B or equivalent. Basic knowledge in Matlab programming is recommended.

Course Registration

You can register for the course at

<https://docs.google.com/spreadsheets/viewform?formkey=dHFwN2tFU0k2cE1UQ2JXSWVHeDNjRmc6MQ>

Please use your KTH mail address when registering. Your registered KTH email address will then be used to send course information to you.

Course Structure

The course includes lectures (48 h), course assistance hours (18 h), and examination (4h). Reading instructions related to each lecture are given in the schedule (see the course homepage). During the course assistance hours, the teaching assistant will be available to assist the students with the assignments and/or project work.

The course is taught in English.

Student Office

STEX – Studerandeexpeditionen

Osqudas väg 10

Phone 08-790 9086/7

Course Literature

The following book is highly recommended for this course: J.F. Manwell, J.G. McGowan, A.L. Rogers, *Wind Energy Explained: Theory, Design and Application, Second edition*. It can be bought from STEX for 500 SEK.

In addition, overhead and online material can be found on the course webpage.

Home Assignments

Five facultative assignments are included in this course. Solutions to these assignments should be presented as written reports. The assignments may give up to 10 additional points to the exam if they are handed in on time (see the schedule). These additional points can be applied to the ordinary exam in May and the following re-exam in August 2012, provided that the examinee has passed the exam. The assignments are designed to give the students basic understanding essential for passing this course.

The assignments will be uploaded on the course webpage.

The assignments should be completed individually and the report containing all solutions should be submitted in the blue box marked EG2040, outside the student room at Teknikringen 33. If Matlab is used for completing the assignment the code should be included with the report.

Solutions to the assignments should be well motivated and explained in detail. All equations used should be written clearly and all variables clarified. Figures and tables should be properly scaled and have captions. Write your name and student number on the front page of the assignment.

The teaching assistant will be available to answer questions during the scheduled course assistance hours.

Project

There is also a course project, where a group of 3 or 4 students makes a technical and economical pre-feasibility study for an imaginary wind farm project given real wind data, location, electrical network topology etc.

The project description and data will be uploaded on the course webpage.

The reports summarising the results of the project should be submitted in the blue box marked EG2040, outside the student room at Teknikringen 33 and also uploaded on Bilda as a pdf file only (no other format will be accepted) (see the schedule for the deadline).

Each project group will also receive a project report from another group to read. They should then act as an opponent by preparing some questions to ask about the report. A number of lecture occasions are reserved for project presentations.

Upon completing of the project, the students are rewarded 1.5 hp (ECTS credits).

Examination

Rules regulating written examinations at the Royal Institute of Technology (KTH) can be found on [KTH Intranet](#).

The examination is a single-part examination. Upon completing the course work and passing the final exam, which is given twice a year, the students are awarded 6 hp (ECTS credits). The regular exam is given in May and a re-examination will take place in August.

At KTH it is compulsory to register for examinations. In order to be eligible for a seat during the exam, the examinee must file this registration in advance. Please use the electronic booking system in <https://www.kth.se/student/minasidor/>.

The final grade of the course is given according to Table 1.

Overall available points	
Maximum points	
Exam	100
Assignments	10
Total	110

Table 1: Exam grading table

Total score: Exam+Assignments	Grade
0–57	F
58–60	FX*
61–68	E
69–76	D
77–84	C
85–92	B
93–110	A

FX*: conditional fail.

Schedule

The schedule can be found on the course webpage.

Study Trip

We plan to organize a 2-day study trip involving a visit to a wind farm and a visit to a company, e.g. a wind turbine manufacturer, system operator. For the study trip in 2011 we went to Denmark.

Participation in the study trip is not compulsory. Costs for the study trip are shared between the students and the department. Typically the costs for each student are around 500–700 SEK.

Course Evaluation

Your feedback is important for continuously improving of the course. Any feedback you have during the course can be sent to eg2040@ee.kth.se during the course, and an evaluation form will be available at the end of the course.