ELEN10 – Wind Power Systems

Course program 2018

Overview
The course provides 7.5 credits and includes 14 lectures, 6 exercises, 2 assignments, 1 project, 1 micro-siting exercise, 1 simulation exercise and 1 laboratory exercise. The course information can be found at the course web site www.iea.lth.se/wps/

Minimum requirements to pass
Approved project, assignments, micro-siting exercise, simulation exercise, laboratory exercise and written exam.

Exam
Written exam: Monday 14 January 2019 at 14.00-19.00, room MA10 F,G,H (grade U, 3, 4 or 5).

Literature

Course schedule:

<table>
<thead>
<tr>
<th>W</th>
<th>Monday 15.15-17.00 E:C</th>
<th>Wednesday 15.15-17.00 M:E</th>
<th>Friday 13.15-15.00 E:C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L1</td>
<td>L2</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>L3</td>
<td>L4 (E:C)</td>
<td>E1</td>
</tr>
<tr>
<td>3</td>
<td>L5</td>
<td>L6</td>
<td>E2</td>
</tr>
<tr>
<td>4</td>
<td>L7</td>
<td>L8</td>
<td>E3</td>
</tr>
<tr>
<td>5</td>
<td>L9</td>
<td>L10</td>
<td>E4</td>
</tr>
<tr>
<td>6</td>
<td>L11</td>
<td>L12</td>
<td>E5</td>
</tr>
<tr>
<td>7</td>
<td>L13</td>
<td>L14</td>
<td>E6</td>
</tr>
</tbody>
</table>

L=Lecture, E=Exercise
## Lecture program:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Book</th>
<th>Responsible</th>
</tr>
</thead>
</table>
| **L1** Introduction, Course information  
Wind turbines - overview | [1,6,8,12] | JS |
| **L2** Wind turbines - historic and modern  
Wind energy applications,  
*Project assignment* | [6,7,8,10] | JS |
| **L3** Large-scale offshore wind power plants: Rödsand 2  
(Overview - Siting, System design, Construction) | [9] | JS |
| **L4** Localisation, Siting  
Wind characteristics and resources  
*Assignment1: wind energy and production estimate* | [2,9] | JS |
| **L5** Environmental aspects and impacts  
Micro-siting, system design (optimizing, wake)  
*Micro-siting exercise (description)* | [9,12] | JS |
| **L6** Micro-siting, (construction investment, losses)  
Wind energy system economics (cost analyses)  
*Assignment2: project financials* | [9,11] | JS |
| **L7** Guest lecture: Enercon Wind Turbines - Grid Integration and Wind Farm Control  
Richard Ogiewa, Enercon Sales- Grid Integration | [5,8,9] | RO |
| **L8** Aerodynamics of wind turbines (models)  
Mechanics and dynamics (models) | [3,4,6,7] | JS |
| **L9** Electrical aspects of wind turbines (models)  
*Simulation and Laboratory exercises (description)* | [5] | JS |
| **L10** Grid integration  
Wind turbine control (models) | [8,9] | JS/Extern |
| **L11** Material and components (wear & tear, availability)  
Operation & maintenance (availability, efficiency) | [6,8] | JS/Extern |
| **L12** System control and wind power integration | [8, 9] | JS |
| **L13** Energy markets and wind power interaction  
Wind forecasting and impacts | [9] | JS/Extern |
| **L14** Project presentations and oppositions  
Repetition | | JS |
Exercise program:

<table>
<thead>
<tr>
<th>Problems from the textbook</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 2.1, 2.2, 2.3, 2.4 2.5, 2.6, 2.7, 2.8, 2.10</td>
<td>JS</td>
</tr>
<tr>
<td>E3 3.1, 3.2, 4.1, 4.2, 4.3, 4.4, 6.1, 6.2, 6.6, 6.9, 6.11</td>
<td>JS</td>
</tr>
<tr>
<td>E4 5.4, 5.5, 5.6, 5.8, 5.9, 5.11, 5.13, 5.16, 9.5, 9.6</td>
<td>JS</td>
</tr>
<tr>
<td>E5 8.5, 8.6, 8.10 (+availability)</td>
<td>JS</td>
</tr>
<tr>
<td>E6 10.1, 10.2 (+reserve)</td>
<td>JS</td>
</tr>
</tbody>
</table>

Project, assignments, micro-siting, simulation and lab exercises

Information and instructions can be found on the course website www.iea.lth.se/wps/. The micro-siting, simulation and lab exercises will be scheduled during week 4-7.

Study visit

A study visit is planned to Lillgrund Wind Farm in week 1-4 depending on number of visitors, weather and logistics.

Personnel & Student Office

Jörgen Svensson, course coordinator, lectures, exercises and simulation exercise, jorgen.svensson@iea.lth.se, 046-222 9288

Lars Lindgren, simulation exercises lars.lindgren@iea.lth.se

Max Collins, laboratory exercises, max.collins@iea.lth.se

Fredrik Lindelöw, micro-siting exercises, Fredrik.lindelow@eit.lth.se

Carina Lindström, Student office. The IEA student administration is located in M-house, second floor, opening hours 11.00-12.30, studexp@iea.lth.se, 046–222 92 90.