Monitoring systems practice has become essential for any production process, mainly due to its high degree of automation. This increasingly is applied to systems and electrical installations. This course wants the students to start in this field, giving an overview of the elements involved and their main characteristics. The main objective of this course is to introduce students to the field of monitoring systems, providing expertise on the elements that are part of this task, the criteria for assessing the needs of each process, as well as for choosing the best option in each case. During the course will be exercises and case studies for a better understanding of new concepts and problems.
## 320170 - SSE - Supervision of Electrical Systems

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
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<tr>
<td></td>
<td>Hours medium group:</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>30h</td>
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<tr>
<td></td>
<td>Guided activities:</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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</table>
# 320170 - SSE - Supervision of Electrical Systems

## Content

<table>
<thead>
<tr>
<th>TOPIC 1: Introduction to Systems supervising</th>
<th>Learning time: 20h</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 8h</td>
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<tr>
<td></td>
<td>Self study: 12h</td>
</tr>
</tbody>
</table>

**Description:**
1.1 Introduction.
1.2 Automated Systems and supervision systems.
1.3 Structure of the system for supervision.
1.4 Automation of electrical power systems.
1.5 Historical development in the automation of electrical power systems.

**Related activities:**
- Understand the contributions of automated supervision.
- Understand the development of monitoring electrical systems.

<table>
<thead>
<tr>
<th>TOPIC 2: Elements to acquire data, control and supervise systems</th>
<th>Learning time: 34h</th>
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<td>Guided activities: 4h</td>
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<tr>
<td></td>
<td>Self study: 18h</td>
</tr>
</tbody>
</table>

**Description:**
2.1 Sensors and measurement systems.
2.2 Pre-actuators and actuators.
2.3 MTU's and RTU's.
2.4 HMI elements.

**Related activities:**
- Understand the elements involved in monitoring systems.
- Establish the theoretical bases about the monitoring systems structure.
- Provide criteria for the selection of the elements involved in the supervision.
### TOPIC 3: Industrial Communications

**Description:**
- 3.1 Introduction to communications.
- 3.2 Standards protocols and OSI model.
- 3.3 Remote access to the substations.
- 3.4 Intelligent local elements.
- 3.5 DPN3, IEC-60870, IEC-61850, IEC-61400 and IEC 62271-3.
- 3.6 OPC technology.

**Related activities:**
- Establish the theoretical bases for industrial communications.
- Provide criteria for selection of communication depending on the application.
- To present the current protocols for monitoring electrical systems.

<table>
<thead>
<tr>
<th>Learning time: 30h</th>
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<tbody>
<tr>
<td>Theory classes: 12h</td>
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<tr>
<td>Self study: 18h</td>
</tr>
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</table>

### TOPIC 4. Architectures for the automation of power electric systems and SCADA systems

**Description:**
- 4.1 Introduction to SCADA systems. Structure.
- 4.2 Hardware and firmware associated with SCADA.
- 4.3 Centralized and distributed structures
- 4.4 MES and ERP systems.

**Related activities:**
- Establish the theoretical bases for understanding the structure of SCADA systems and elements.
- Provide criteria for selection of SCADA systems.

<table>
<thead>
<tr>
<th>Learning time: 28h</th>
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<tr>
<td>Theory classes: 11h</td>
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<td>Self study: 17h</td>
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</table>
TOPIC 5: Industrial applications

Learning time: 20h
Theory classes: 8h
Self study: 12h

Description:
5.1 SCADA systems business.
5.2 Current systems for monitoring electrical power systems.
5.3 Security.
5.4 Practical considerations.
5.5 Examples

Related activities:
- To present current applications and components for monitoring electrical systems.
- Present case studies and practical solutions for monitoring.

Qualification system

- 1st Exam: 20%
- 2nd Exam: 20%
- Practices: 25%
- Activities: 25%
- Continuous Evaluation: 10%

Bibliography

Basic:
Strauss, Cobus. Practical electrical network automation and communication systems [on line]. Amsterdam: Elsevier, 2003

Complementary:
0849368359.
Clarke, G.; Reynders, D.; Wright, E. Practical modern SCADA protocols: DNP3, 60870.5 and related systems. Amsterdam: