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.
### Study load

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<tr>
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<th>Total learning time: 150h</th>
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<tr>
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<td>Hours medium group:</td>
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<tr>
<td>Hours small group:</td>
<td>30h 20.00%</td>
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<tr>
<td>Guided activities:</td>
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<td>Self study:</td>
<td>90h 60.00%</td>
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## Content

<table>
<thead>
<tr>
<th>TOPIC 1: Introduction to Systems supervising</th>
<th>Learning time: 20h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 8h</td>
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<td>Self study: 12h</td>
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### 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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<td>Self study: 18h</td>
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</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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<td>Self study: 18h</td>
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### 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>
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<th>Learning time: 28h</th>
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### TOPIC 5: Industrial applications

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<td>Theory classes: 8h</td>
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<tr>
<td></td>
<td>Self study: 12h</td>
</tr>
</tbody>
</table>

**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.

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### Qualification system

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<th>Exam</th>
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### Bibliography

**Basic:**


**Complementary:**