240EI014 - Electrical Technology

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 709 - EE - Department of Electrical Engineering
Academic year: 2017
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits: 3
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: ROBERTO VILLAFÁFILA ROBLES

Others:

Opening hours
Timetable: To be decided with the students

Degree competences to which the subject contributes

Specific:
CEMEI08. Ability to design and project automatic production systems and advanced control processes.
CEMEI01. Knowledge and ability to analyse and design the generation, transport and distribution systems in electric energy.

General:
CGMEI02. (ENG) Projectar, calcular i disenyar productes, procesos, instal.lacions i plantes.

Transversal:
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

Teaching methodology

Exhibition in the Classes that combine theory and problems. The participatory development of the problems will be made in the form. There will also be laboratory practicals.

Learning objectives of the subject

At the end of the course, the student should be able to:
* Understand operation of power systems
* Apply criteria in the selection and sizing of the components of an electrical installation.
* Learn the basics of automation of industrial processes and know-how simple grafcet programs for programmable logic controllers.
## Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 17h</th>
<th>22.67%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group: 10h</td>
<td>13.33%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 48h</td>
<td>64.00%</td>
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</tbody>
</table>
### Content

#### Power system

**Description:**
- Elements and agents in power system:
  - Conventional structure
  - Evolution: smart grids, microgrids, HVDC
- Electrical market and contracting

**Related activities:**
Problem solving

**Specific objectives:**
Know technological, technic and economical framework of power systems.

**Learning time:** 7h
- Practical classes: 2h 30m
- Self study: 4h 30m

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#### Electrical installations

**Description:**
- Electrical safety
  - Electric shock
  - Direct and indirect contact
- Neutral connection systems
  - Grounding of reference and protection
- Conductors and electrical cables:
  - General: parts and materials
  - Selection criteria: maximum current, maximum voltage drop, maximum short-circuit current
- Defects and protection of installations:
  - Concepts of: overload, short-circuit, ground fault, overvoltage
  - Calculation of the short-circuit current
  - Overcurrent protections: fuses, thermal relays and circuit breakers
  - Earth leakage protection: differential switches and relays
- Power quality:
  - Causes, effects and solutions

**Related activities:**
Problems

**Specific objectives:**
Understand the main issues of safety in electrical installations
Learn to determine the required conductors in electrical facilities for different application
Learn to select determining the protection devices against overcurrent and earth leakage
Understand power quality issues and their mitigation

**Learning time:** 31h 25m
- Practical classes: 10h 30m
- Self study: 20h 55m
### Static power converters and storage

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>5h 35m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Self study:</td>
<td>3h 35m</td>
</tr>
</tbody>
</table>

**Description:**
- Types of static power converters and uses
- Types of storage systems

**Related activities:**
- Problems

**Specific objectives:**
Know how to identify the different types of static power converters and storage system, and their main characteristics.

### Industrial automation

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>31h</th>
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</thead>
<tbody>
<tr>
<td>Practical classes:</td>
<td>5h</td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>10h</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>4h</td>
</tr>
<tr>
<td>Self study:</td>
<td>12h</td>
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</tbody>
</table>

**Description:**
- Industry 4.0
- Elements of a system to automate electromechanical automation
- PLCs
- Programming Languages
- Grafcet
- Elements of supervision

**Related activities:**
- practices

**Specific objectives:**
- Understanding evolution of productive processes until Industry 4.0
- Meet the automation, architecture and applications.
- Learn to do basic programming in PLC grafcet
- Learn the basic operation of the monitor elements
### Planning of activities

| Laboratory practice | Hours: 10h  
Laboratory classes: 10h |
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<thead>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Designing the five simple program to automate processes and program in the PLC</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Scripts of practices and laboratory equipment</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td></td>
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</tbody>
</table>
Evidence: The preliminary design of the programs |
| **Specific objectives:** | Understand the operation of PLCs  
Understanding the language and expertise grafcet simple programs with it |

| PARTIAL EXAMINATION | Hours: 1h 15m  
Theory classes: 1h 15m |
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<thead>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Examination of the first part of the course</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Statement, Form and Calculator</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td></td>
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</table>
Examination |
| **Specific objectives:** | See if acquired knowledge are well |

| FINAL EXAMINATION | Hours: 3h  
Theory classes: 3h |
<table>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Review the content of the subject having a share of problems and an explanatory section on practices and away from the subject of the problems are not</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Statement, Form and Calculator</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td></td>
</tr>
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</table>
Examination |
| **Specific objectives:** | See if acquired knowledge are well |
Qualification system

The final mark will be the highest from the following expressions:

Nota f1 = 0.5 x Mark of the final exam + 0.25 x Mark of the Practices + 0.25 x Mark of the partial exam

Nota f2 = 0.7 x Mark of the Final Exam + 0.3 x Mark of the Practices

Mark of the Final Exam = 0,5 x Theory + 0,5 x Problems

Students that do not attend the final examination or the practices will be evaluated with NP

The mark of the practices will be the average of the marks from each of the scheduled practices. The practices which have not been carried out will be punctuated with a zero.

If present at the examination of reassessment, the same expressions apply for the calculation of the ratings but replaces the final exam for the exam reevaluation.

Regulations for carrying out activities

The exam or midterm and final exams will be conducted on the dates and times designated by the School.

The final exam (Like the reassessment exam) consists of a part in which concepts of theory and laboratory practices and wonder of problems. The share of problems, the student may use a calculator and sheet form.

Bibliography

Others resources:

NOTES AND VIDEOS OF THE SUBJECT TO BE ACCESSIBLE FROM DIGITAL CAMPUS