LECTURER

Coordinating lecturer: Arnau Dòria Cerezo

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific: CEGTI 9. (ENG) Coneixement d'electrònica, electricitat, teoria de circuits i màquines elèctriques.

TEACHING METHODOLOGY

The total teaching load of the subject is 59 hours: 49 hours are taught in slate classrooms (30 theory hours and 19 practical hours) and 10 hours dedicated to lab practices. The weekly distribution is:

- Two weekly work sessions in a class (with a duration between one hour and a half and two hours, until the total load of 49 hours), which outlines the basic theory aspects with the support of teaching material and many practical examples.
- Five practical lab sessions of two hours each session (approximately, one session every two weeks).

An additional dedication of one hour and a half for every hour of class is expected from the student, with a slight increase in the last themes.

LEARNING OBJECTIVES OF THE SUBJECT

The overall objective of the subject is providing students with the basic skills which are necessary for the electrical circuit analysis in sinusoidal steady-state.

The specific objectives are:

- knowledge of the models for the active and passive components of the electrical circuits,
- Kirchhoff's laws,
- electrical circuits general solution,
- ability of analysis and solution of electrical circuits in direct current and sinusoidal steady-state, the latter using the phasor domain technique,
- learn the notion of instantaneous, active, reactive and apparent power associated with electrical circuits in sinusoidal steady-state,
- use the Node Analysis (NA) for electrical circuit analysis,
- (grounded and isolated) wye and delta connections,
- power measurement in three phase systems,
- choose the capacitor to improve the installation power factor,
- analyze the distribution system configurations more common (radial and meshed), and
- model transformers as components of the distribution networks, with preferable use of pu values.
**STUDY LOAD**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>50,0</td>
<td>33.33</td>
</tr>
<tr>
<td>Hours small group</td>
<td>10,0</td>
<td>6.67</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

**Total learning time**: 150 h

**CONTENTS**

**Single-phase circuit analysis**

**Description:**
1.1 Sign conventions

1.2 Circuit analysis
Analysis of circuits containing voltage and current sources

1.3 Circuits in sinusoidal steady-state

1.4 Power in sinusoidal steady-state circuits
Instantaneous power absorbed and delivered by an active or passive two-terminal element. Active, reactive, and apparent power in AC circuits. Additivity of active, reactive and apparent complex powers. Power factor. Wattmeters. Reactive power consumption. Power factor correction.

1.5 Thévenin and Norton equivalent circuits
Thévenin and Norton theorems. Short circuit power. Thévenin-load problems.
### Single-phase circuit analysis

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1.5 Thévenin and Norton equivalent circuits
Thévenin and Norton theorems. Short circuit power. Thévenin-load problems.

**Full-or-part-time:** 38h 30m
Theory classes: 12h 50m
Practical classes: 6h 25m

### Node voltage method

**Description:**

2.1 Introduction and definitions

2.2 Node analysis (NA). Thévenin equivalent circuit

2.3 Modified node analysis (MNA): incorporation of ideal voltage sources and magnetic couplings

**Full-or-part-time:** 3h 30m
Theory classes: 2h 20m
Practical classes: 1h 10m
Three-phase circuit analysis

Description:
3.1 Three-phase systems justification

3.2 Definitions
Symmetrical and balanced systems. Positive and negative sequences. Symmetrical and unsymmetrical loads

3.3 Three-phase loads study

3.4 Symmetrical systems with symmetrical loads

3.5 Three-phase power measurement
Apparent complex power evaluation in grounded and isolated systems. Measure, by means of wattmeters, of the active and reactive powers in grounded systems. Measure, by means of wattmeters, of the active and reactive powers in isolated systems

Full-or-part-time: 12h 15m
Theory classes: 8h 10m
Practical classes: 4h 05m

Distribution network analysis

Description:
4.1 Voltage drops, losses and conductor section evaluation

4.2 Distribution networks with P-Q loads

Full-or-part-time: 5h 15m
Theory classes: 3h 30m
Practical classes: 1h 45m
Analysis of electrical transformers

Description:
5.1 Ideal single-phase transformer

5.2 Non-ideal single-phase transformer
Non-ideal single-phase transformer. Reduction of a circuit with a non-ideal single-phase transformer. Approximated schemes. Load operation: load index, voltage drop, coefficient of performance and reactive power consumption. The most usual bases: pu, primary and secondary. Base changes: from pu to the primary and secondary

5.3 Nameplate of the non-ideal transformer
Laboratory tests for parameters determination

5.4 Three-phase transformer
Reduction of a circuit with a three-phase transformer. Use of the reduced scheme. The most usual bases: pu, primary and secondary

5.5 Cascade and parallel connected transformers
Reduction of a circuit with cascade and parallel connected transformers. Base changes.

Full-or-part-time: 8h 45m
Theory classes: 5h 50m
Practical classes: 2h 55m

GRADING SYSTEM

For ordinary evaluation the final mark will be

\[ N_{\text{FINAL}} = 0.15 \times N_{\text{Pr}} + 0.85 \times (0.35 \times N_{\text{P}} + 0.65 \times N_{\text{F}}) \]

where \( N_{\text{Pr}} \) is the mark of lab sessions, \( N_{\text{P}} \) is the mark of the partial exam and \( N_{\text{F}} \) is the mark of the final exam.

Assistance, participation and delivering the final report is a necessary condition for being evaluated. In other cases, the final mark of the course will be NP (Not Presented).

COURSE REEVALUATION:

The students who failed have a new reevaluation of the course. Only the matriculated students in one or both semesters can access to the reevaluation exam. In this case, the final mark will be

\[ N_{\text{FINAL}} = \max(N_{\text{R}}, N_{\text{ORD}}) \]

where \( N_{\text{R}} \) and \( N_{\text{ORD}} \) are the marks of the reevaluation exam and the ordinary evaluation, respectively.

Condition to access at the reevaluation exam is to have, at least one mark correspondint to the final exam, the partial exam or the laboratori sessions.

BIBLIOGRAPHY

Basic: