Electrical power system protection

Academic Year: (2022 / 2023) **Review date: 20-05-2022**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: SORRENTINO , ELMER

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Fundamentals of Electrical Engineering
Electrical Lines and Switchgear
Electric Power Systems
AC Electrical Machines
Electrical Installations
Magnetic circuits and transformers

OBJECTIVES

The student obtains skills for selecting the settings of main electrical protections for electric distribution and transmission systems, as well as knowledge to understand the operation of these protections.

DESCRIPTION OF CONTENTS: PROGRAMME

-1: Fundamentals about electric power system protection. Basic definitions. Functions and features of protection systems.

-2: Short circuit analysis. Computation of short-circuit currents, using symmetrical components. Effects of fault currents.

-3: Protection of low-voltage electric systems. Description of protective devices. Coordination of protective devices.

-4: Protection of medium-voltage electric systems. Description of protective devices. Coordination of protective devices.

-5: Distance protection and differential protection. Fundamentals about distance protection. Self-polarization of distance protection and fault analysis. Communication-assisted trip for distance protections. Differential protection for transmission lines and differential protection for transformers.

-6: Protection of synchronous generators and other protection systems. Available protective functions for synchronous generators. Other available protections for transmission lines and transformers. Busbar protection. Breaker-failure protection. Other protective functions for electric power systems and wide area protection systems.

LEARNING ACTIVITIES AND METHODOLOGY

-Lectures, sessions for solving doubts in reduced groups, individual tutorials and personal work of the student, oriented to the learning of theoretical knowledge (3 ECTS credits).

-Analysis and solving of practical exercises in reduced groups, laboratory sessions, individual tutorials and personal work of the student, oriented to the obtaining of practical skills related to the contents of the subject (3 ECTS credits).

ASSESSMENT SYSTEM

Continuous assessment, based on 3 exams, with the same weighting factor for each exam. The result of this continuous assessment can be taken as the 100% of the final grade for this course.

-Final exam in regular call:
The final exam is optional for students. Students can take the final exam, if they want; in such case, the weighting factor of the final exam is 60% and the weighting factor of continuous assessment is 40%.

-Extraordinary call:
If the student followed the continuous assessment, the weighting factor of the final exam is 60% and the weighting factor of continuous assessment is 40%. If the student didn't follow the continuous assessment, the exam of extraordinary call has a 100% of value in the final mark.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Blackburn, J. and Domin, T. Protective Relaying: Principles and Applications, CRC Press, 2014
- Das, J. Power System Protective Relaying, CRC Press, 2018
- Gers, J. and Holmes, E. Protection of Electricity Distribution Networks, IET, 2011
- Iriondo Barrenetxea, A. Protecciones de Sistemas de Potencia, Universidad del País Vasco, 1996
- Montané Sangrá, P. Protecciones en las Instalaciones Eléctricas: Evolución y perspectivas, MARCOMBO, 1993
- Suarez Creo, Juan M. Protección de Instalaciones y redes eléctricas, Andavira, 2011
- Ziegler, G. Numerical Distance Protection: Principles and Applications, Siemens, 2011
- Ziegler, G. Numerical Differential Protection: Principles and Applications, Siemens, 2012

BASIC ELECTRONIC RESOURCES

- IEEE . IEEE Std. 242-2001: IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (IEEE Buff Book): https://ieeexplore.ieee.org/document/974402
- IEEE . IEEE Std. C37.91-2008: IEEE Guide for Protecting Power Transformers: https://ieeexplore.ieee.org/document/4534870
- IEEE . IEEE Std C37.113-2015: IEEE Guide for Protective Relay Applications to Transmission Lines: https://ieeexplore.ieee.org/document/7502047
- IEEE . IEEE Std C37.102-2006: IEEE Guide for AC Generator Protection: https://ieeexplore.ieee.org/document/8526571