Electric power stations I

Academic Year: (2023 / 2024) **Review date: 28-03-2023**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: ORDUÑEZ DEL PINO, MIGUEL ANGEL

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Magnetic circuits and transformers.
- Alternating current electrical machines.
- Electric power systems.
- Electric power stations I.

SKILLS AND LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
COCIN1. Ability to draft, sign and develop projects in the area of industrial engineering for construction, renovation, repair, preservation, demolition, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical and electronic installations, industrial plants and installations and automation and manufacturing processes.
COCIN4. Ability to resolve problems with initiative, decision-making, creativity, and critical reasoning skills and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering field.
COCIN5. Knowledge to perform measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar jobs.
COCIN7. Ability to analyze and assess the social and environmental impact of technical solutions.
CEP1. Capacity to design a system, component or process in the area of electrical engineering in compliance with required specifications.
CER10. Basic and applied knowledge in environmental and sustainability technologies.
CEP2. Knowledge and ability to apply computational and experimental tools for analysis and quantification of electrical engineering problems.
ECRT9. Ability to design electrical power plants.

By the end of this content area, students will be able to have:
RA1.3. Coherent knowledge of the branch of electrical engineering including some at the forefront of their branch in electric power generation.
RA2.1. The ability to apply their knowledge and understanding to identify, formulate and solve problems of electric power generation using established methods.
RA2.2. The ability to apply their knowledge and understanding to analyse engineering products, processes and methods.
RA2.3. The ability to select and apply relevant analytic and modelling methods in electric power generation.
RA3.1. The ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements.
RA3.2. An understanding of design methodologies, and an ability to use them.
RA4.1. The ability to conduct searches of literature, and to use data bases and other sources of information.
RA4.2. The ability to design and conduct appropriate experiments, interpret the data and draw conclusions.
RA5.1. The ability to select and use appropriate equipment, tools and methods in electric power generation.
RA5.2. The ability to combine theory and practice to solve electrical engineering problems.
RA5.3. An understanding of applicable techniques and methods in electric power generation, and of

their limitations.
RA5.4. An awareness of the non-technical implications of engineering practice.
RA6.3. Demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, and commit to professional ethics, responsibilities and norms of engineering practice.

OBJECTIVES

The objectives of this course are to provide a sound basis in the electrical side of a generation power plant. In particular all issues related with one line and three line diagrams, selection of transformers for the power plant, grounding calculation, generator circuit breaker selection, and design & setting of the protection system.

At the end of the course, the student will be able to:
- Identify the electrical system of a generation power plant.
- Selection of the proper values to buy transformers for connection with the network and for connection with the ancillary system.
- Grounding Assessment for generator power plant.
- Definition of the protective system.
- Evaluation of the monitoring and maintenance procedures.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Types of Generation Power plants. History and main characteristics. Demand supply.
2. Power Plant Operation and Maintenance.
3. Cost analysis. LCOE procedure to assess costs for Nuclear, Coal and Combined Cycle technologies.
4. Generation power plant general scheme. Project stages. One line and three line diagrams.
5. Pumping power plants. Types and characteristics.
6. Functional characteristics of a Generator. Grounding method for generators.
7. Isolated phase busbar. Generator circuit breaker. Main power transformer.
8. Auxiliary services for generator power plants. Loads and voltage level.
9. Short-circuit currents and voltage drop in the different parts of the power plant. Criteria for auxiliary transformer assessment.
10. Protection relay introduction. Faults and abnormal condition in generators.
11. Specific generator protection criteria.
12. Generator regulation. Voltage and velocity regulation. F-P regulator.
13. Control system. Introduction to 61850.
14. Power Electronics in Power Stations. International connections. DC Technologies (HVDC).

LEARNING ACTIVITIES AND METHODOLOGY

- Magisterial classes to explain the main theoretical concepts of the subject and presentations from pupils.
- Reduced groups to solve problems by the teacher.

ASSESSMENT SYSTEM

Continuous assessment based on working groups tasks presented to the classmates, papers, class participation and partial tests to check the knowledge and abilities acquired during the course.

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

BASIC BIBLIOGRAPHY

- A.K. Raja; Amit Prakash Srivastava; Manish Dwivedi Power Plant Engineering, NEW AGE INTERNATIONAL PUBLISHERS, 2005
- Stan Kaplan POWER PLANT CARACTERISTICS AND COSTS, Nova Science Publishers, 2009