MANAGEMENT AND AUTOMATION OF ELECTRIC SYSTEMS

Enrollment year	2018/2019
Academic year	2019/2020
Regulations	DM270
Academic discipline	ING-IND/33 (ELECTRICAL ENERGY SYSTEMS)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRICAL ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	(30/09/2019 - 20/01/2020)
ECTS	6
Lesson hours	52 lesson hours
Language	Italian, English
Activity type	WRITTEN AND ORAL TEST
Teacher	BENZI FRANCESCO (titolare) - 2 ECTS BAGGINI ANGELO - 4 ECTS
Prerequisites	Basic knowledge of the electrical system provided by the courses for the Bachelor's Degree in Electrical Engineering and Industrial Engineering.
Learning outcomes	Deepening and completion of the concepts learned in the Bachelor's Degree in Electrical Engineering, with particular reference to the production control systems, electricity transmission and distribution, to the supervision and control schemes for power generation plants, the regulation of the frequency and voltage on the electrical networks. The notion of Smart Grid, and the role of communication systems and energy measurement systems (Smart metering).
Course contents	1. Frequency and voltage regulation Control of real load and frequency in the electrical system by frequency regulation; primary and secondary frequency regulation. Definition of the

Area Control Error (ACE) and its management in large interconnected systems. Regulation of voltage and reactive power. Model of a generator excitation system.

2. Stability of the electrical system
Dynamic behaviour of the electrical system. Stability of the system to small and large changes. Study of load and frequency oscillation with the use of the method of the areas. Transient analysis studies by integration of a model with many machines.

3. SCADA Systems
Supervisory and control systems for the management of electrical systems. The finctions of system supervision and data acquisition (SCADA) for a generation and transmission of electricity system.

4. Smart Grid - Definition.
Definition and description of the Smart Grid, compared to the traditional power network. Technologies required to implement the Smart Grid.

5. Communication systems for the Smart Grid.
Outline of communication protocols and characteristics of protocols and architectures used for Smart Grid network.

6. Smart Metering.
Electronic energy meters (Smart meters) main features of the first and second generation. Their role in the Smart Grid architecture.

Teaching methods	The course consists of lectures and exercises, some of which are to be carried out by computer.
Reccomended or required readings	P. Pinceti. SCADA per sistemi elettrici. Franco Angeli, Milano. N. Faletti, P. Chizzolini. Trasmissione e distribuzione dell'energia elettrica, (2° vol.). Pàtron, Bologna. F. Iliceto. Impianti elettrici, Vol. 1. Pàtron, Bologna. Notes about Smart Grid will be made available through the Kiro platform.
Assessment methods	The exam consists of a written test and an oral test on the course subjects.
Further information	==
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile