



AUTOMATION AND COMMUNICATION IN INDUSTRIAL SYSTEMS

Anno immatricolazione	2015/2016
Anno offerta	2016/2017
Normativa	DM270
SSD	ING-IND/32 (CONVERTITORI, MACCHINE E AZIONAMENTI ELETTRICI)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	INDUSTRIAL AUTOMATION ENGINEERING - INGEGNERIA DELL'AUTOMAZIONE INDUSTRIALE
Curriculum	PERCORSO COMUNE
Anno di corso	2°
Periodo didattico	Primo Semestre (26/09/2016 - 13/01/2017)
Crediti	6
Ore	45 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO E ORALE CONGIUNTI
Docente	BENZI FRANCESCO (titolare) - 2 CFU CANAZZA VIRGINIA - 3 CFU MONTAGNA MARIO - 1 CFU
Prerequisiti	Basic knowledge of electrical power generation and transmission system.
Obiettivi formativi	Get acquainted with the basic problem of defining an acceptable operating point for the electrical power system. Provide a complete picture of the operation of the wholesale electricity market in Italy, both in its structural components in the organizational aspects, and a first comparison with the European market models.
Programma e contenuti	1. Operating states of the electrical system Definitions of "operating state" proposed in the technical literature: the

difference between the normal, alert and emergency state.

2. Load flow calculation
Finding the operating conditions of the electrical system. Definition of system load; loading and generation buses; the slack bus for the balance of the real powers. Solution of the load flow problem by the method of Newton-Raphson. Methods of decoupled load flow solution (Carpentier, Stott) and approximate load flow methods (d.c. load flow).

3. FACTS devices
The operational constraints of the electrical system (current / power flows, voltage levels). FACTS devices as an effective tool to achieve compliance with the operational constraints. Analysis of the main types of FACTS devices.

4. Electricity markets
Fundamental theory to understand market dynamics and the interrelations between its various stages; specialized analysis of regulation, use of simulation models, critical analysis of market performance based on public data, investment appraisal. Systems planning, to transfer basic knowledge and skills for an extensive overview on current and future trends in industry.

Metodi didattici

The course consists of lectures and exercises, some of which are to be carried out by computer.

Testi di riferimento

Course handouts.
F. Iliceto, Impianti Elettrici, vol. I, Pàtron ed., Bologna
R. Marconato, Electric Power Systems, CEI ed., Milano
S. Stoft, Power System Economics, IEEE/Wiley (2002)
P. Ranci, Economia dell'energia, Manuali, Il Mulino
Relazioni annuali GME
Relazioni Annuali AEEGSI
Piano di Sviluppo annuali di Terna
Vademecum Borsa Elettrica Italiana del GME
F. C. Schweppe et al., Spot pricing of electricity, Kluwer Academic Publishers (1988)
G. Strbac et al. - Fundamentals of Power System Economics, John Wiley & Sons (2004)
D. R. Biggar et al., The Economics of Electricity Markets, IEEE/Wiley (2014)
ENTSOE, Survey on Ancillary services procurement, Balancing market design 2014 (2015)

Modalità verifica apprendimento

The exam consists of a written test and an oral test on the course subjects.

Altre informazioni

The exam consists of a written test and an oral test on the course subjects.

Obiettivi Agenda 2030 per lo sviluppo sostenibile

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