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# Laboratorio di telecomunicazioni

## Finalità

Introducing Students to the world of measurements in Telecommunications, with a strong emphasis on industrial scope. Great attention is set in order to get acquainted Students with the most-used instruments and on the data acquisition procedures utilized in Research, Development and Validations Laboratories of main Telecommunications Firms.

Part of the Course is developed with the effective collaboration of the main instrumentation- and network-equipment suppliers, as Anritsu, Tektronix and Cisco Systems. They give talks on particular subjects and lend part of the equipments for the laboratory activities.

## Programma

- \* Statistical Methods applied to measurement theory
  - o Measurement Errors
    - + Measurements representation
    - + Errors in direct and in indirect measurements
    - + Errors propagation
    - + Errors propagation in presence of uncorrelated errors
  - o Statistical Distributions
    - + Uniform Distribution
    - + Gaussian Distribution
  - o Valuers Use
    - + Average as True-Value valuer
    - + Variance as Error Valuer
    - + Weighted Average
    - + Data rejection; Chauvenet's Criterion
  - o Least-Squares Method
    - + Independent variable with negligible uncertainty
    - + Independent variable with not-negligible uncertainty
  - o Covariance and Correlation
- \* Electrical Instrumentation
  - o Real Time Oscilloscope (in collaboration with Tektronix)
  - o Sampling Oscilloscope (in collaboration with Tektronix)
  - o Electrical Spectrum Analyzer
  - o Network Analyzer (in collaboration with Anritsu)
- \* Optical Instrumentation
  - o Optical Spectrum Analyzer
  - o Tunable Laser Source
  - o Multichannel Optical Transmitter
  - o Amplified Multichannel Optical Receiver
- \* Data Collection and Analysis
  - o GPIB Bus
  - o LabView Interface
- \* Laboratory Experiences: Theoretical Analysis
  - o Amplitude Modulation
  - o Baseband Digital Modulations (in collaboration with Tektronix)
  - o Use of Network Analyzer in characterizing RF devices (in collaboration with Anritsu)
  - o Erbium-Doped Fiber Amplifier Characterization (in collaboration with Anritsu)
    - o 10 Gb/s BER and Q measurements in amplified multichannel optical systems (in collaboration with Cisco Systems)
- \* Talks Tentative Scheduling:
  - o 14/04/2005: Ing. Canafoglia - Cisco Systems  
EMI and ESD measurements for telecommunication equipment in central office environment.
  - o 18/04/2005: Ing. Soffientini - Tektronix  
Modern Oscilloscopes Capabilities
  - o 02/05/2005: Ing. Balzerini - Anritsu  
Vectorial Network Analyzers and their use in Telecommunication
  - o 16/05/2005: Ing. Moscheni - Tektronix  
Jitter in 10 Gb/s systems: sources and test strategy
  - o 23/05/2005: Ing. Mazzini - Cisco Systems  
The Industrial Process for Telecom Products; Agenda
  - o 24/05/2005: Ing. Mazzini - Cisco Systems  
Test Strategies for Products in Industrial Environments; Agenda

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### Modalità d'esame

Examination is based on individual reports on laboratory experiments and on a talk. Reports due date is in two weeks before the examination date.

### Testi consigliati

Teacher's Materials: <a href="http://www.tlc.unipr.it/dimaio/">http://www.tlc.unipr.it/dimaio/</a>