COMMUNICATION ENGINEERING AND ELECTRONIC TECHNOLOGIES

(Lecce - Università degli Studi)

Teaching INSTRUMENTATION AND MEASUREMENT LABORATORY

GenCod A006428

Owner professor Andrea Maria CATALDO

Teaching in italian INSTRUMENTATION AND MEASUREMENT LABORATORY

Teaching INSTRUMENTATION AND MEASUREMENT LABORATORY

SSD code ING-INF/07

Reference course COMMUNICATION ENGINEERING AND ELECTRONIC

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 54.0

For enrolled in 2021/2022

Taught in 2022/2023

Course year 2

Language ENGLISH

Curriculum PERCORSO COMUNE

Location Lecce

Semester First Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

The course provides the basic concepts for a correct use of measurement instrumentation adopted in testing, diagnostics and metrological characterization of components, devices and telecommunication systems.
Instrumentation and measurement methods mainly adopted in the field of TLC and electronic applications will be presented, analysed and used.
The course also includes several practical laboratory sessions.

REQUIREMENTS

Electronics, Signal Theory, Electromagnetic fields, Electronic Measurements

COURSE AIMS	**1) Knowledge and understanding** The course describes methods and models in the field of measurement systems and apparata with a specific focus on TLC. Students must have basic knowledge related to electronics, electronic components, signal theory. They should know the main electronic architectures and signal acquisition systems operating both in time and frequency domains. They should be able to deal efficiently with practical applications and measurement issues with a specific skill to cope with the intrinsic limitation between theoretical models and practical cases. **2) Applying knowledge and understanding** At the end of the course, the student should be able to apply rigorously the basic and most important concepts related to metrology for a generic measurement process. Specifically, the student should be able to correctly use measurement instrumentations adopted in testing, diagnostics and characterization of components, devices and telecommunication systems. **3) Making judgements** Students will possess the ability to identify the operating modalities for correlating a theoretical concept or model with the most appropriate practical context. The course promotes the development of independent judgment suitable to appropriately choose the measurement technique as well as the critical ability to interpret the goodness of the results of the models/methods applied to the datasets under examination. **4) Communication** Through the methodologic tools provided in the course and, in particular, those addressed during the laboratory sessions, students will be able to communicate with an appropriate technical terminology so as to proficiently deal with all the issues related to measurements, data acquisition and processing, testing activity and results. Additionally, thanks to the laboratory sessions, the students will have the opportunity to draft autonomously a technical report describing the practical and theoretical issues related to the discussed topics. **5) Learning skills** Students must acquire the critical ability to relate, with originality and autonomy, to the typical problems of measuring a quantity, characterizing a TLC signal and testing electronic devices and components. They will also be able to use instrumentation and measurement methods largely adopted in the field of TLC applications and they should be able to apply autonomously the knowledge and methods learned in view both of a possible PhD courses as well as of a professional carreer.
TEACHING METHODOLOGY	The course is highly characterised by a practical approach thus, in addition to traditional lessons, several practical laboratory sessions are carried out.
ASSESSMENT TYPE	Oral and practical exam, including the production of a technical report describing the laboratory experiments.
OTHER USEFUL INFORMATION	**Office Hours** On appointment; contact the professor by email.

FULL SYLLABUS

Theory

1) Basic principles of measurement and metrology
- Measurement definitions
- Measurement concepts of errors, uncertainty, metrologic characterization
- Probabilistic approach to measurement theory
- Uncertainty definitions and evaluation methods
- Metrological characterization of instrumentation
- Instrument specifications, errors and uncertainties

2) Sampling and AD/DA Conversion
- Theoretical principles of sampling
- Sampling in real cases and practical issues
- Sampling of one-shot and periodic signals
- Errors and non-idealities in sampling
- Theoretical principles of A/D and D/A conversion
- Quantization, errors and non-idealities
- A/D and D/A signal characteristics
- Principles, characteristics and architectures of main A/D Converters

3) Oscilloscopes and time-domain measurements
- Basics, functionalities and architectures of DSO (Digital Storage Oscilloscopes)
- Equivalent-time sampling (sequential and syncronous modality)
- Issues on practical use of instruments operating in time domain

4) Spectrum analyzers and frequency-domain measurements
- Basics, functionalities and architectures of spectrum analyzers
- Frequency-domain analysis of generic signals, modulated signals and related parameters
- Noise analysis, characterizaion and related parameters

5) Networks and transmission line measurements
- Time and frequency domain reflectometry
- Vector network analyzers and scattering parameters

Laboratory

1) Oscilloscopes and time-domain measurements
- Measurements and characterization of various components, devices and systems (i.e.: impedances, passive and active filters, amplifiers, oscillators).

2) Spectrum analyzers and frequency-domain measurements
- Basic measurements on sample signals (sinusoidal signals, distorted signals, etc.)
- Measurements of typical parameters TLC signals (THD, SNR, signal tracking, etc.)
- Measurements of typical parameters in modulated signals

3)Networks and transmission lines measurements
- TDR measurement examples and estimation of parameters in transmission lines
- Scattering parameters measurements in time and frequency domains

REFERENCE TEXT BOOKS	[1] Notes directly provided by the Lecturer [2] A. Cataldo, N. Giaquinto, E. De Benedetto, A. Masciullo, G. Cannazza et al."Basic Theory and Laboratory Experiments in Measurement and Instrumentation. A Practice-Oriented Guide" Lecture Notes in Electrical Engineering, Springer Verlag, 2020 [3] A. Cataldo, E. De Benedetto, G. Cannazza, "Broadband Reflectometry for Enhanced Diagnostics and Monitoring Applications", Lecture Notes in Electrical Engineering,Springer Verlag, 2011