



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
MASTER'S DEGREE (MSC)	ELECTRICAL ENGINEERING
SUBJECT	MEASUREMENTS AND TESTINGS FOR ELECTRICAL ENGINEERING
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50363-Ingegneria elettrica
CODE	19865
SCIENTIFIC SECTOR(S)	ING-INF/07
HEAD PROFESSOR(S)	SPATARO CIRO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	12
INDIVIDUAL STUDY (Hrs)	192
COURSE ACTIVITY (Hrs)	108
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	SPATARO CIRO Tuesday 11:00 13:00 Laboratorio Misure Elettriche (DEIM III piano)

PREREQUISITES	Knowledge of: metrology; measurement uncertainty; measurement methods and instruments; statistics and probability assessment; electric power systems; electric machines.
LEARNING OUTCOMES	<p>Knowledge and understanding Students are expected to acquire knowledge and understanding concerning:</p> <ul style="list-style-type: none"> •standards, methods, instrumentations for the diagnosis and for the qualification of electrical components, equipment, appliances, machinery, installations, also considering the aspects related to the electrical and electromagnetic safety; •statistical process control techniques; acceptance testing methods; reliability theory; reliability tests of component and systems; reliability improvement techniques. <p>Students acquire knowledge and understanding by means of lectures, exercises and personal study. These skills are assessed during the exam asking the student to express topics debated during the course.</p> <p>Applying knowledge and understanding Students are expected to be able to:</p> <ul style="list-style-type: none"> • characterize, qualify and diagnose electrical components, equipment, machinery, systems; •test the grounding systems and the electrical safety of electrical installations; •measure electromagnetic fields and characterize environments regarding the electromagnetic safety, •interpret the relevant standards of characterization and testing, putting into practice the test and diagnostic procedures; •select and use the instruments and methods for the diagnosis, characterization and testing of electrical components, equipment, machines, installations, carrying out the aforesaid activities in safety conditions; •implement a quality management system, analyze a production process and manage an acceptance test; •assess and test the reliability of component and systems and implement reliability improvement techniques. <p>Students acquire the ability of knowledge and understanding by means of the study of case studies discussed during the lectures and of exercises also conducted by using dedicated software. These skills are assessed during the exam asking the student to extrapolate what learned during the lectures and to apply it to practical cases.</p> <p>Making judgments Students will be able to collect and interpret data on measurements and testing; he will be able to determine judgments of compliance to standards, having awareness of the related implications. The student will also got the ability to integrate knowledge and handle complexity, and formulate judgements starting from incomplete or limited information. Students will be able to undertake the suitable corrective, preventive and improvement actions in the quality management; to collect suitable data to manage a production process; to choose the suitable test type; to compare the reliability characteristics of components and systems. To achieve this outcome, during lectures and exercises, the students are asked to handle independently practical cases. The outcome is assessed during the exam asking the student to solve a practical case not studied during the course.</p> <p>Communications skills The student will be able to communicate the results of the activities of inspection and testing, and the procedures used, his conclusions and the knowledge and rationale underpinning them, doing this also by means of test reports and addressing both specialist and non-specialist audiences clearly and unambiguously. Students will be also able to report, with competence and correct use of language, the results of a process control, an acceptance test and a reliability test. Students acquire these skills by means of discussions done during lectures and exercises. The outcome is assessed during the exam, considering both the student oral presentation and his report writing.</p> <p>Learning skills Students are expected to acquire the learning skills indispensable to start further studies and, independently, to handle whatever problem concerning the measurement, the diagnosis and the tests in the electrical engineering field, the process control and the reliability area. To achieve these skills, the students are made aware of the existence of the subject perspectives that cannot be debated during the course. These skills are assessed during the report discussion.</p>
ASSESSMENT METHODS	

	<p>The assessment is performed by means of an oral exam (30 minutes of average duration) which consists of:</p> <ul style="list-style-type: none"> •at least 5 essay questions chosen from the whole course program; •the discussion of the reports on the tests carried out during the course. <p>During the exam it will be evaluated:</p> <ul style="list-style-type: none"> •knowledge and understanding of the course program; •ability to apply the knowledge for problem solving within the course or related contexts; •concepts reinterpretation, critical aptitudes and connection skills in disciplinary or interdisciplinary contexts; •correct use of language and writing, clearness, fluency. <p>Marks are out of 30 and the minimum mark for passing the test is 18/30. The mark is awarded considering to what extent the student has achieved the learning outcomes. The following scheme can be assumed for reference:</p> <p>28-30 with distinction Full contents mastery; no errors; self-corrections/integrations of inaccuracies/ omissions; correct and rigorous approach to problems; correct, complete and effective solutions; some originality evidence; effective concepts reworking, coherent and autonomous approaches and judgments, disciplinary/ interdisciplinary connections; very clear presentation, structured arguments, correct use of language.</p> <p>24-27 Good knowledge and understanding of course contents; few minor errors, partially fostered self-corrections or integrations; good approach to problems, essentially correct solutions; good coherence in linking concepts and approaching disciplinary or related subjects; good presentation, adequate use of language.</p> <p>18-23 Sufficient knowledge of contents; feasible approach to problems although with limited autonomy, acceptable solutions; errors or omissions not serious; sufficient concepts links within disciplinary contexts, although tentative and guided; basic presentation and use of language.</p> <p>Below 18 Learning outcomes are not sufficiently met.</p> <p>In the middle of the course, the students carry out an ongoing written test with essay questions on the already discussed course program. Aim of this test is making aware the students about their knowledge of the subject. The final mark is not depending on the outcome of the ongoing test.</p>
EDUCATIONAL OBJECTIVES	<ul style="list-style-type: none"> •Knowing standards, methods, instrumentations for the diagnosis and for the qualification of electrical components, equipment, appliances, machinery, installations, considering the aspects concerning the conformity assessment and the electrical and electromagnetic safety. •Analyzing and controlling a productive process. •Designing and managing an acceptance test. •Assessing the reliability of components and systems. •Improving the reliability of components and systems.
TEACHING METHODS	Lectures, exercises, case studies analysis and classroom discussion.
SUGGESTED BIBLIOGRAPHY	<ul style="list-style-type: none"> •Dispense fornite dal docente. •Professor lecture notes.

SYLLABUS

Hrs	Frontal teaching
4	General information on testing activities in the electrical engineering
2	Standards, European directives, conformity assessment. Quality standards ISO 9001 and ISO/IEC 17025
4	Safety in electrical testing at work and in the laboratory
10	Electrical, thermal, mechanical measurements. Measuring instruments; various transducers; ancillary equipment.
2	Automated measurement and test systems
2	Insulation tests
2	Temperature rise tests
4	Electromagnetic compatibility tests

SYLLABUS

Hrs	Frontal teaching
2	Appliances electrical safety tests
4	Tests on transformers
4	Tests on asynchronous machines
2	Tests on d.c. machines
2	Tests on synchronous machines
2	Cable testing and fault location
2	Inspection and testing of electrical installations: instruments and quality management of measurements
2	Inspection and testing of electrical installations: visual inspections
2	Inspection and testing of electrical installations: measurements and tests
2	Power quality measurements
2	Measurements of electromagnetic fields for the assessment of human exposure.
2	Testing photovoltaic systems
2	Fundamentals of statistics and probability assessment
2	Statistical process control
2	Control charts
2	Acceptance test
2	Reliability, availability and maintainability. Reliability functions and parameters
2	Reliability assessment of components; degradation phenomena and models; tests
2	Reliability assessment of systems
2	FMEA, FMECA, FTA techniques; Markov models
2	Availability improvement techniques
Hrs	Workshops
10	Dealing with measurement instruments
3	Tests on transformers
3	Temperature rise tests
3	Tests on asynchronous machines
3	Electrical safety testing of equipment
3	EMC tests
4	Measurements and tests to verify the safety of electrical installations
3	Statistical process control software