



## COURSE DESCRIPTION DESIGN OF ELECTRIC MACHINES

**SSD: CONVERTITORI, MACCHINE E AZIONAMENTI ELETTRICI  
(ING-IND/32)**

DEGREE PROGRAMME: INGEGNERIA ELETTRICA (M60)  
ACADEMIC YEAR 2022/2023

### COURSE DESCRIPTION

TEACHER: RIZZO RENATO  
PHONE: 081-7683231  
EMAIL: renato.rizzo@unina.it

### GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE  
MODULE: NOT APPLICABLE  
CHANNEL: FG A-Z  
YEAR OF THE DEGREE PROGRAMME: II  
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II  
CFU: 6

#### REQUIRED PRELIMINARY COURSES

None.

#### PREREQUISITES

There are no particular prerequisites apart from the contents of the courses included in the study plan.

#### LEARNING GOALS

The course has the aim to give the basic elements for the design of rotating electrical machines, with particular regard to the induction machines for industrial applications.

#### EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

##### Knowledge and understanding

The student will acquire methodologies and procedures for the sizing and design of rotating electrical machines, with particular reference to asynchronous machines. He will be able to apply

the procedures and methodologies acquired to set up a preliminary design of electric machines.

### **Applying knowledge and understanding**

Ability to apply the procedures and methodologies acquired to set up the sizing and a preliminary design of electric machines.

## **COURSE CONTENT/SYLLABUS**

*Principal Laws and Methods in Electrical Machine Design.*

*Windings of Electrical Machines:* Basic Principles, Three-Phase Integral Slot Stator Winding, Short Pitching, Poly-Phase Fractional Slot Windings, Single- and Two-Phase Windings, Commutator Windings, Compensating Windings and Commutating Poles, Rotor Windings of Asynchronous Machines, Damper Windings.

*Design of Magnetic Circuits:* Air Gap and its Magnetic Voltage, Equivalent Core Length, Magnetic Voltage of a Tooth and a Salient Pole, Magnetic Voltage of Stator and Rotor Yokes, No-Load Curve, Equivalent Air Gap and Magnetizing Current of the Machine, Magnetic Materials of a Rotating Machine, Permanent Magnets in Rotating Machines.

*Flux Leakage, Resistances. Main Dimensions of a Rotating Machine:* Mechanical, Electrical and Magnetic Loadability.

*Design Process and Properties of Rotating Electrical Machines:* Asynchronous Motor (Current Linkage and Torque Production of an Asynchronous Machine, Impedance and Current Linkage of a Cage Winding, Characteristics of an Induction Machine, Equivalent Circuit Taking Asynchronous Torques and Harmonics into Account, Synchronous Torques, Selection of the Slot Number of a Cage Winding, Construction of an Induction Motor, Cooling and Duty Types, Examples of the Parameters of Three-Phase Industrial Induction Motors).

## **READINGS/BIBLIOGRAPHY**

Lectures notes.

Textbook (Juha Pyrhonen, Tapani Jokinen and Valeria Hrabovcova: *Design Of Rotating Electrical Machines*, John Wiley & Sons)

## **TEACHING METHODS OF THE COURSE (OR MODULE)**

Lectures and project work

## **EXAMINATION/EVALUATION CRITERIA**

### **a) Exam type**

- Written
- Oral
- Project discussion
- Other

**In case of a written exam, questions refer to**

- Multiple choice answers
- Open answers
- Numerical exercises

**b) Evaluation pattern**