

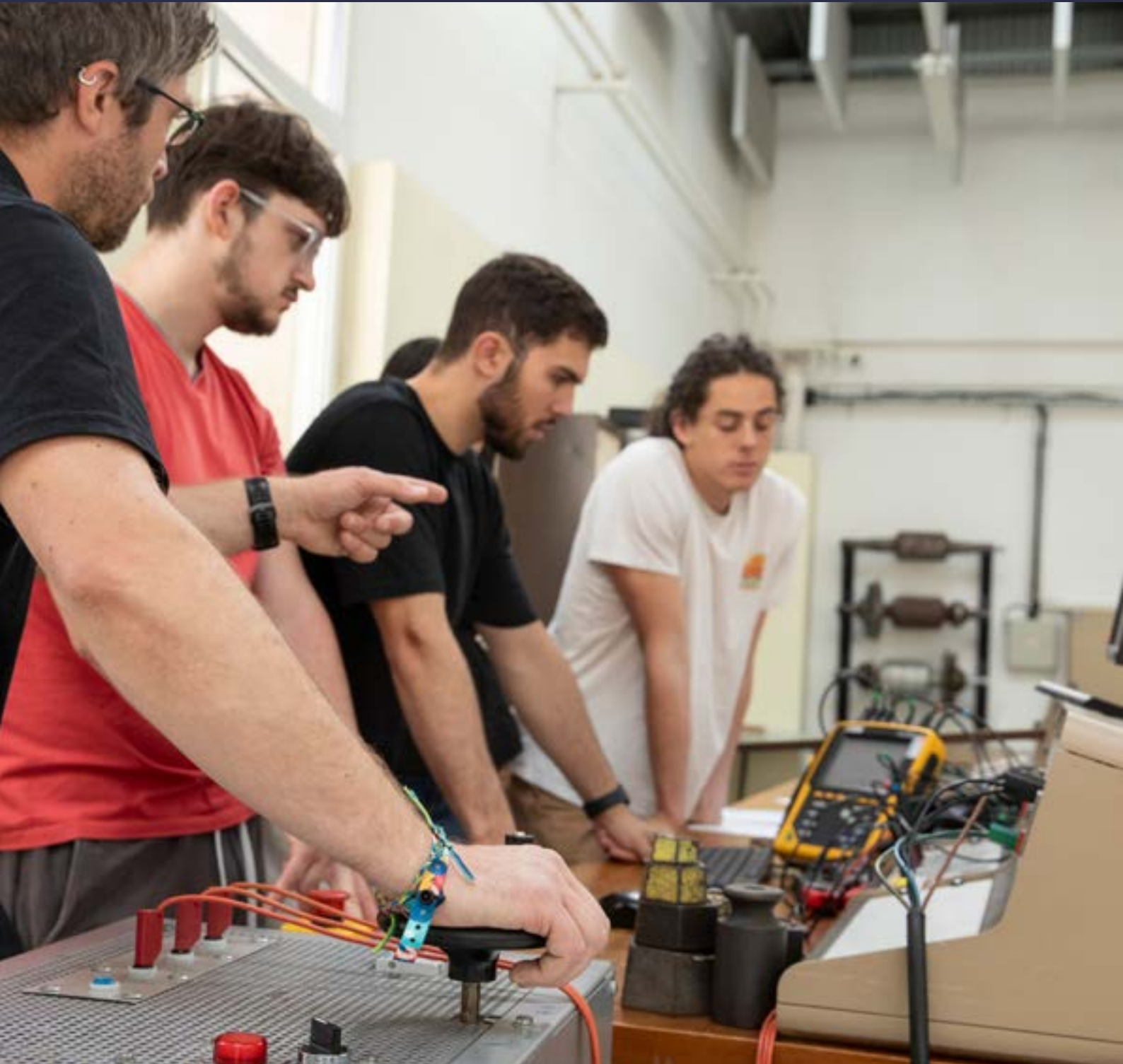
Short Syllabus

ELECTRICAL ENGINEERING

LORRAINE
INP Ensem

ÉCOLE D'INGÉNIEURS CRÉE EN 1900

Fall Semester



PROGRAM DESCRIPTION

ENSEM – S9 COURSE CATALOGUE-COURSES AVAILABLE IN ENGLISH

Fall Semester | Master Level / Second Cycle

Engineering Specialisations

This catalogue presents the courses taught in English available to international exchange students at S9 (Master level / second cycle) at ENSEM, Université de Lorraine.

Electrical Machines – Modeling and Design

Course name	Lectures	Lab work	ECTS	Hours	Course reference
ANALYTICAL MODELING AND OPTIMIZATION OF ELECTRICAL MACHINES	16	44	5	60	

Course Description

This course develops analytical and numerical methods for the modelling, sizing, optimisation and design of electrical machines.

Main Topics

- Analytical modelling of electrical machines
- Electrical-machine sizing
- Equivalent-circuit parameter identification
- Design optimisation
- AC-machine windings
- Numerical modelling of synchronous and asynchronous machines
- Preliminary design of permanent-magnet machines
- Finite-element modelling
- FEMM and FluxMotor

Learning Outcomes

Students will be able to:

- analyse technical documentation;
- develop a machine-sizing tool using MATLAB or Python;
- formulate an optimisation problem;
- design and simulate electrical-machine windings;
- carry out preliminary machine design;
- use finite-element simulation tools.

Prerequisites

- Electrical Machines
- General Electrical Engineering – Electric Power systems

Assessment

Written examination and individual machine-sizing/design report.

Electromagnetic Compatibility

Course name	Lectures	Lab work	ECTS	Hours	Course reference
ELECTROMAGNETIC COMPATIBILITY	14	16	2.5	30	

Course Description

This course introduces electromagnetic compatibility (EMC) issues in power-conversion systems and provides methods for modelling, measuring and reducing electromagnetic disturbances.

Main Topics

- EMC in DC/DC converters
- High-frequency imperfections
- Harmonic propagation
- High-frequency switching-cell modelling
- Common-mode and differential-mode disturbances
- EMC standards
- Disturbance measurement using LISN/RSIL
- EMC filter design
- EMC in AC systems
- High-frequency modelling of electrical machines
- Conducted-emission filtering

Learning Outcomes

Students will be able to:

- identify and model EMC phenomena;
- analyse power converters while taking high-frequency effects into account;
- design and evaluate filtering solutions.

Assessment

Written examination and practical-work report.

High-Availability Electromechanical Conversion – Part 2

Course name	Lectures	Lab work	ECTS	Hours	Course reference
HIGH-AVAILABILITY ELECTROMECHANICAL CONVERSION	14	16	2.5	30	

Course Description

This course focuses on fault detection, fault-tolerant operation and degraded operating modes in electromechanical energy-conversion systems.

Main Topics

- Electrical-machine faults in Permanent-magnet synchronous machines
- Inter-turn stator short circuits
- Three-phase inverter faults
- Sensorless control
- Fault-tolerant control
- Industrial case studies

Learning Outcomes

Students will be able to:

- model electrical machines under fault conditions;
- identify characteristic fault signatures;
- implement control strategies in the event of mechanical-sensor failure.

Prerequisites

- Electrical Machines and their control
- Power Electronics

Assessment

Practical-work and project reports, plus examination.

Power-Hardware-in-the-Loop (P-HIL)

Course name	Lectures	Lab work	ECTS	Hours	Course reference
P-HIL TOOLS AND TECHNIQUES	10	40	5	60	

Course Description

This course introduces Power-Hardware-in-the-Loop approaches for the testing and validation of power-electronics and electrical-energy systems.(+ 10 hours tutorials)

Main Topics

- P-HIL principles
- P-HIL tools and techniques
- Hardware-in-the-loop testing
- Practical implementation
- Testing and validation of power-conversion systems
- Engineering project

Learning Outcomes

Students will be able to:

- explain the principles of P-HIL testing;
- use P-HIL tools and techniques;
- analyse power-conversion systems through hardware-in-the-loop experimentation;
- validate engineering solutions experimentally.

Assessment

Practical/project work and associated deliverables.

Academic / Industrial R&D Project

Course name	Lectures	Lab work	ECTS	Hours	Course reference
ACADEMIC / INDUSTRIAL R&D PROJECT			10	120	

Course Description

This project enables students to apply the knowledge and skills acquired during their engineering studies to a concrete research or industrial development problem.

Projects may be carried out individually or in groups and may be proposed by an academic or industrial partner.

Main Project Stages

- Definition of project objectives
- Requirements and expected outcomes
- Functional and technical specifications
- Design and simulation
- Development
- Validation
- Analysis and reporting

Learning Outcomes

Students will gain experience in carrying out a substantial engineering project and in applying their technical knowledge to an open-ended problem.

Assessment

- Project report
- Oral defence

International Communication

Course name	Lectures	Lab work	ECTS	Hours	Course reference
PROFESSIONAL AND SCIENTIFIC COMMUNICATION	24	0	2.5	24	

Course Description

The English component is organised around two complementary areas: Professional Communication and Scientific Communication.

Professional Communication prepares students to work effectively in international professional environments, including job applications, interviews, personal branding, meetings, negotiations and project presentations.

Scientific Communication focuses on written and oral communication in scientific and technical contexts.

Main Topics

- Job applications and interviews
- CV and personal branding
- Professional communication
- International teamwork
- Meetings and negotiations
- Technical presentations
- Scientific report writing
- Abstract writing
- Technical English
- Explaining and simplifying technical concepts
- Oral scientific communication

Learning Outcomes

Students will be able to:

- communicate effectively in English in professional and scientific contexts;
- produce clear written technical and scientific documents;
- present technical information orally;
- interact effectively in international and intercultural environments.

Prerequisites

B2 level of English.

Assessment

Continuous assessment through written work, oral participation and final assessments.

International Communication

Course name	Lectures	Lab work	ECTS	Hours	Course reference
FRENCH LANGUAGE	24	0	2.5	24	

This course will introduce students to French culture and life in France through linguistic activities and exercises.

Classes will be based on various authentic documents. Through class-work students will improve their ability to build sentences in French while discovering French culture

Learning Outcomes

By the end of the course students will be able to introduce themselves, talk about interests and their environment and ask questions to others about familiar topics.

Students will be given assignments to help them review the points covered in class and prepare for upcoming classes.

Main Topics

- Socio-cultural contents (greetings, family life in France, daily routines, shopping in France, French food, work culture, etc.)
- Communication tasks (greeting people, introducing yourself, speaking about your family and habits, asking something politely, ordering food and drinks, speaking about your experience and your future plans, etc..)
- Grammar (être and avoir, articles, 1st group verbs, present, conditional in polite expressions, future, passé composé etc..)
- Vocabulary (nationalities, adjectives describing personality, family members, the house, frequency adverbs, most useful verbs, shops, food, work, jobs, studies, etc...)

Assessment

regular oral and written tests

LORRAINE INP Ensem

GRADUATE SCHOOL OF ENGINEERING SINCE 1900



École Nationale Supérieure
d'Électricité et de Mécanique



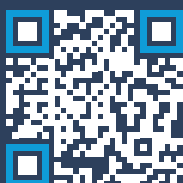
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