Summary
The course is dealing with high performance drives and methods to control various electrical machines by means of power electronic converter and advanced control methods.

Content
Introduction: Applications of variable speed drives. Role of power electronics. Types of the electric machines.
DC Machines: Construction and types of DC machines. Modeling and static characteristics. Power electronic converters for 4Q operation. Control system design and tuning.
AC Machines - Asynchronous Machine: Construction and types of AC machines. Models in the original domain, stationary reference frame and rotational reference frame. Static characteristics and operational ranges (e.g. field weakening). Power electronic converters for AC machines. Pulse Width Modulation - PWM. Space Vector PWM - SVPWM. Scalar control (open loop and closed loop). Vector control - Rotor Field Oriented Control (RFOC). Direct RFOC. Indirect RFOC. Direct Torque Control (DTC)

Learning Prerequisites
Required courses
EE-365 Power Electronics
EE-465 Industrial electronics I

Important concepts to start the course
Students should be familiar with basics of: power electronics conversion, cascaded control loops, PID type of regulators, pulse width modulation, electric circuit simulations

Learning Outcomes
By the end of the course, the student must be able to:
• Design a vector control system
• Conceive a control strategy for an electric machine
• Conceive a control for a converter connected to the grid
• Design a variable speed drive system
• Implement a control strategy for an electric machine
• Realize desired control objectives and performances

Teaching methods
Slides, Blackboard, PLECS examples, Exercises based on the modeling and simulations using PLECS, Reporting

**Expected student activities**
Attendance of lectures; Completing exercises; Writing reports based on the exercises, Proactiveness

**Supervision**
Assistants: Yes

**Resources**
**Bibliography**

**Ressources en bibliothèque**
- *Electrical Machines / Vukosavic*

**Notes/Handbook**
Lectures, exercises and solutions are available on the Moodle

**Moodle Link**