



## EEE6201      **ADVANCED CONTROL OF ELECTRIC DRIVES**

**Credits:**                      **15**

### **Course Description including Aims**

Building upon the “Motion Control Systems” unit, this module explores advanced modelling and modern control strategies of electric drive systems with a focus on induction (IM) and permanent magnet synchronous machines (PMSM). The main aims of the unit are:

1. To understand the components of modern drive systems including power electronics, sensors and real-time controllers.
2. To analyse the dynamics of IM and PMSM and understand their transient behaviour.
3. To analyse in details the design, operational constraints and dynamic performance of vector and direct torque control strategies for electric drives.
4. To develop an understanding of advanced control methodologies and open research issues including sensor-less drive operation.
5. To effectively understand and use computer modelling for dynamic simulation of electrical drives and design of control algorithms.

### **Outline Syllabus**

**Introduction to the control of electric drive systems:** Components of a drive systems, sensors and real time control. **Dynamic modelling of AC machines:** Review of reference frame transformations, dynamic models of induction and permanent magnet brushless DC and AC machines. **Vector control of AC machines.** Speed and current control loop design. Operating regions of AC drives, voltage and current limitations, flux weakening control. **Direct torque and flux control of AC machines.** **Speed and position sensorless control of IM and PM machines.** **Computer modelling and simulation of electrical drives and control systems.**

### **Time Allocation**

36 lectures plus 12 hours of support material.

### **Recommended Previous Courses**

E6203 “Motion Control an servo drives”

### **Assessment**

3-hour examination, answer 4 questions from 6.

## Recommended Books

D.W. Novotny T. Lipo	<i>Vector control and dynamics of AC drives</i>	Clarendon Press, Oxford
M.P. Kazmierkowki R. Krishnan F. Blaabjerg	<i>Control of Electric Machine Drive System</i>	IEEE Press
Bose, B.K.	<i>Control in Power Electronics – Selected Problems Power Electronics and Variable Frequency Drives</i>	Academic Press IEEE Press

## Objectives

By the end of this module successful students will be able to:

1. describe and select components for an electric drive system.
2. demonstrate detailed understanding of the dynamic behaviour of IM and PMSM.
3. use computer modelling for drive system analysis and control design.
4. display in-depth knowledge of vector and direct torque control strategies used in modern drive systems.
5. display a knowledge of advanced and open research topics in electrical drives systems.