



The  
University  
Of  
Sheffield.

Electronic &  
Electrical  
Engineering.

## EEE6140 MACHINE DESIGN

Credits: 10

### Course Description including Aims

The aims are:

1. To develop an understanding of the relationship between dimensions and rating of machines.
2. To introduce the principles of winding designs.
3. To develop techniques for the design of permanent magnet machines.
4. To calculate representative winding reactances.

### Outline Syllabus

**Machine Ratings** : leading dimension of machines, electric and magnetic loadings, thermal design considerations. **Windings** : types of windings, their design, choice of winding arrangements, harmonic effects. winding reactances. **Permanent Magnets** : types of magnet, analysis and design of PM devices, design of permanent magnet machines.

### Time Allocation

24 lectures plus 12 hours of additional support material.

### Recommended Previous Courses

EEE202 'Electromechanical energy conversion'.

### Assessment

2 Hour examination, answer 3 questions from 4.

### Recommended Books

|                                     |   |                     |
|-------------------------------------|---|---------------------|
| Say, M.G.                           | <i>Alternating Current Machines</i>                           | (McGraw-Hill)       |
| Miller, T.J.E.                      | <i>Brushless Permanent-Magnet and Reluctance Motor Drives</i> | (Oxford Science)    |
| Hendershot, J.R.&<br>Miller, T.J.E. | <i>Design of Brushless Permanent Magnet Motors</i>            | (Oxford Science)    |
| Kenjo, T.                           | <i>Permanent Magnet and Brushless DC Motors</i>               | (Oxford Science)    |
| Lipo, T.A.                          | <i>Introduction to AC machine design</i>                      | (Univ of Wisconsin) |

## **Objectives**

On completion of the module successful students will be able to

1. Calculate the leading dimensions of a machine subject to the specified design constraints.
2. Develop winding layouts and calculate the harmonic content of their mmf or of the emf induced in the windings by a rotating field.
3. Suggest the choice of an appropriate permanent magnet material and its main dimensions when used in an electric machine.
4. Develop the skill for magnetic circuit analysis of permanent magnet machines, including working point, airgap flux density, maximum energy product, demagnetisation withstand and temperature effect.
5. Calculate the reactance of a winding or components of the reactance from the dimensions of a machine and relate these to equivalent circuit models developed in earlier years of the course.