

**COURSE TITLE** : ELECTRICAL MACHINE DESIGN  
**COURSE CODE** : 6035  
**COURSE CATEGORY** : E  
**PERIODS/WEEK** : 4  
**PERIODS/SEMESTER** : 60  
**CREDITS** : 4

**TIME SCHEDULE**

MODULE	TOPICS	PERIODS
1	General Aspects of Machine Design	15
2	Design of Transformer and Induction Motor	15
3	Design of Synchronous Machines	15
4	Design of DC Machines	15
<b>Total</b>		<b>60</b>

Course Outcome:

Sl.	Sub	On completion of this course the student will be able:
1	1	To understand the basic principles of machine design.
2	1	To comprehend the design of transformer.
	2	To comprehend the design of induction motors.
3	1	To comprehend the design of alternators.
	2	To understand the armature winding.
4	1	To comprehend the design of DC MACHINES.

Specific Outcome:

**MODULE I General Aspects of Machine Design**

- 1.1.1 To list out different types of materials used in the construction of electrical machines.
- 1.1.2 To describe the properties of copper and aluminum.
- 1.1.3 To list the standard conductor size.
- 1.1.4 To describe the space factor.
- 1.1.5 To list the insulating material used for machine construction.

- 1.1.6 To list the magnetic materials used for machine construction
- 1.1.7 To describe the characteristics, magnetization curve, iron losses.
- 1.1.8 To explain the selection of a material for a particular application.
- 1.1.9 To describe the properties of heating, cooling and ventilation.
- 1.1.10 To state the basic design principles.
- 1.1.11 To explain the output coefficient and their standard values for various machines.
- 1.1.12 To explain the effect of size on specific electric and magnetic loading.
- 1.1.13 To describe the mechanical design of shaft, bearing, cooling fan and frame.

### **MODULE II Design of Transformer and Induction Motor**

- 2.1.1 To state the different types of transformers(core and shell type).
- 2.1.2 To describe the transformers used in the field of generation, transmission and distribution.
- 2.1.3 To design the main dimension of single phase core type transformer with output coefficient, voltage per turn, specific magnetic and electric loading of transformer.
- 2.1.4 To design the main dimension of 3 phase core type transformer with output coefficient, voltage per turn, specific magnetic and electric loading of transformer.
- 2.1.5 To design the winding of transformer – crossover, helix, disc & disc helix.
  
- 2.2.1 To discuss design consideration in AC machines.
- 2.2.2 To explain the power output equation of the Induction motor.
- 2.2.3 To describe the main dimension of Induction motor.
- 2.2.4 To design three phase induction motor with standard frames and stampings, with relevant parameters.
- 2.2.5 To explain the design of stator and rotor winding.

### **MODULE III: Design of Synchronous Machines**

- 3.1.1 To describe the output equation of a synchronous machine.
- 3.1.2 To explain how to determine the number of poles.
  
- 3.2.0 To describe the winding and insulation.
- 3.2.1 To design the main dimension of the stator and rotor core slots.
- 3.2.2 To determine the conductor size.
- 3.2.1 To selection of different types of armature winding for specific use.

### **MODULE IV Design of DC Machines**

- 4.1.1 To explain the main dimensions of the DC machine.
- 4.1.2 To explain the output equation of DC machine.
- 4.1.3 To illustrate the choice of poles in a DC machine.
- 4.1.4 To illustrate the choice of winding.
- 4.1.5 To design of commutator of a DC machine.
- 4.1.6 To design of brush gear of DC machine.
- 4.1.7 To design the field poles and field windings.

## CONTENTS

### MODULE – I

Basic concepts of machine design- materials used for construction – properties and characteristics of magnetic materials - conducting materials and insulating materials- selection of materials. Heating and cooling - basic design principles – output coefficient – specific electric loading – specific magnetic loading – problems. Mechanical design - shaft- bearing – cooling fan – frame.

### MODULE-II

Design of induction machines – transformers – different types – design of main dimensions of single phase core type transformers – problems - design of main dimensions of three phase core type transformers - problems - design of transformer winding - induction motor- design considerations - output equation - main dimensions - design of three phase induction motor – problems.

### MODULE –III

Synchronous machines - output equations - choice of specific magnetic loading - specific electric loading - main dimensions - armature design – armature winding – design of magnetic circuit - problems.

### MODULE IV

Design of DC machines - main dimensions – output equations - design of magnetic circuits – field poles and field windings - design of armature winding – commutator and brush.

### REFERENCES

1. AK Sawhney. A course in electrical machine design: Danpat Rai &co.
2. K G Upadhyay. Design of electrical achiness: New age International.