

COURSE TITLE : **ELECTRICAL MACHINES DESIGN**
COURSE CODE : **5039**
COURSE CATEGORY : **E**
PERIODS/WEEK : **4**
PERIODS/SEMESTER : **72**
CREDITS : **4**

RATIONALE

This subject deals with the design aspects of electrical machines. After completing the modules students will be able to design DC as well as AC Machines.

TIME SCHEDULE

MODULE	TOPIC	PERIODS
I	Basic consideration of electrical machine design & Magnetic circuit calculation	17
	Test I	1
II	Design of transformer	17
	Test II	1
III	Design of DC Machine	17
	Test III	1
IV	Design of AC machine	17
	Test IV	1
	TOTAL	72

OBJECTIVES

MODULE I

Basic consideration of electrical machine design.

- 1.1.0 Explain Static and rotating electrical machines Standardization and standards
- 1.1.1 Familiarize with the Specification of transformer, Dc machines ,Ac machines
- 1.1.2 Describe the Design and constructional elements of rotating electrical machines
- 1.1.3 Describe the Design and constructional elements of Transformer
- 1.1.4 Familiarize with the Material for Static and rotating electrical machines
 - 1.1.4.1 List the requirement of conducting materials for Static and rotating electrical machines
 - 1.1.4.2 List the requirement of magnetic materials for Static and rotating electrical machines
 - 1.1.4.3 List the requirement of Insulating materials for Static and rotating electrical machines
- 1.1.5 Explain Losses in Static and rotating electrical machines –
 - 1.1.5.1 State the design constraints related to Electrical losses in machines
 - 1.1.5.2 Relate the Magnetic losses with machine design

- 1.1.6 Discuss Temperature rise and Class of duty, limits of temperature rise
- 1.2.0 Magnetic circuit calculation**
- 1.2.1 Brief idea of Calculation of magnetizing force in Electrical machines
- 1.2.2 Determine Magnetizing force for air gap in rotating machine
- 1.2.3 Calculate the Magnetizing force for the teeth in Electrical machine
- 1.2.4 Understand Leakage flux, leakage reactance of salient field poles in Rotating machines
- 1.2.5 Familiarize with the Leakage flux, leakage reactance of Non salient field poles in Rotating machines
- 1.2.6 State factors affecting armature slot leakage reactance

MODULE II

2.1.0 Design of transformer

- 2.1.1 Give idea about different types of transformers-core and shell type.
- 2.1.2 Familiarize with the Distribution transformer and transformers used in the field of generation and transmission
- 2.1.3 Understand about Core section ,clearance & yoke section
- 2.1.4 Design the main dimension of single phase core type transformer and 3 phase core type transformer with Output coefficient, Voltage per turn, Specific magnetic and electric loading of transformer
- 2.1.5 Design the Winding of transformer - crossover ,helix, disc & disc helix

MODULE III

3.1.0 Design of DC Machine

- 3.1.1 Explain Important design consideration
- 3.1.2 State advantages of large no. of poles in design of DC machine
- 3.1.3 Design DC machine with the factors like No of poles , ,Air gap ,armature slot ,current density, field system, commutator.
- 3.1.3 Design of large dc motor considering Specific magnetic and electric loading of dc machine
- 3.1.4 prepare Flow chart to estimate for kw rating and dimension of DC machine

MODULE IV

4.1.0 Design of ac machine.

- 4.1.1 Discuss design considerations in ac machines
- 4.1.2 understand the power equation.
- 4.1.3 Separate diameter and length
- 4.1.4 Explain important design consideration of three phase induction motor
- 4.1.5 Design three phase induction motor with standard frames and stampings, gap length ,flux density, current density, power factor-efficiency, slot combination
- 4.1.6 Explain the design of 3 phase induction motor winding
- 4.1.7 Explain important design consideration of three phase synchronous machines
- 4.2.0 Familiarize with details of radial gap length, stator slot ,stator coil and rotor construction of three phase synchronous machine
- 4.2.1 Explain the Design of three phase synchronous machine

COURSE CONTENT

MODULE I

Electrical machines design basic consideration

Standardization and standards, Specification of transformer, Dc machines and ac machines, Design and constructional elements of transformer, Rotating machines, Materials- conducting magnetic and insulating materials, Losses-electrical and magnetic losses ,Temperature rise, Class of duty, limits of temperature rise.

Magnetic circuit calculation

Calculation of magnetizing force, Magnetizing force for gap, Magnetizing force for the teeth, Leakage flux, leakage reactance. Rotating machines- salient field poles, non salient field poles, armature , slot leakage reactance.

MODULE II

Design of transformer

Important considerations – core and shell type, Distribution transformer , generator transformer , transmission transformer, Core section clearance yoke section, Main dimension single phase core type transformer, 3 phase core type transformer, Output coefficient, Voltage per turn, Specific magnetic and electric loading of transformer, Winding design- crossover ,helix, disc & disc helix.

MODULE III

Design of DC Machine

Important design consideration, No of poles, advantageous of large no. of poles,Air gap ,armature slot ,current density field system, commutator, ,Design of large dc motor, Specific magnetic and electric loading of dc machine, Flow chart to estimate for kw and dimension

MODULE IV

Design of ac machine.

ac machine design consideration, power equation., separation of diameter and length- problems, three phase induction motor- important design consideration-standard frames and stampings, gap length ,flux density, current density, power factor-efficiency, slot combination, winding, design of 3 phase induction motor, phase synchronous machines- important design consideration, radial gap length, stator slot stator coil, rotor construction, design of 3 phase synchronous machines.

References

- 1.Principles of electrical machine design S K Sen., Oxford and IBH Publishing co. Pvt ltd.
- 2.The performance and design of ac machines MG Say CBS Publishers and distributors, New Delhi
- 3.Elements of electrical machine design Alfred still, Charls S Siskind MGH Newdelhi