

3/4 B.Tech. SECOND SEMESTER

EE6T1

ELECTRICAL MACHINES DESIGN

Credits: 4

Lecture: 4 periods/week

Internal assessment: 30 marks

Tutorial: 1 period /week

Semester end examination: 70 marks

Objective:

To develop knowledge on principles of design of static and rotating machines. Also students must able to understand the design fundamental concepts, design main dimensions & cooling systems of transformers and main dimensions of rotating machine.

Learning out comes:

1. Upon completing the course, students is able to understand the design of various parts of DC machines and solve the problems of design
2. Student should be able to understand the design concepts of transformers and know about how to design the parts.
3. Student is able to understand the design concepts of synchronous machines and solve the problems related to design.
4. Student understands the importance of design of machines based on their applications.

UNIT I

BASIC CONSIDERATIONS:

Basic concept of design, limitation in design, standardization, modern trends in design and Manufacturing techniques, Classification of insulating materials. Modes of heat dissipation & temperature rise time curves. Methods of cooling ventilation (induced & forced, radial & axial), direct cooling & quantity of cooling medium. Calculation of total mmf and magnetizing current. Specific permeance and leakage reactance.

UNIT II

DESIGN OF DC MACHINES: Output equation, choice of specific loading and choice of number of poles, design of Main dimensions of DC machines, Design of armature slot dimensions, commutator and brushes, magnetic circuit – estimation of ampere turns, design of yoke and poles- main and inter poles, field windings- shunt, series and inter poles.

UNIT III

DESIGN OF TRANSFORMERS(single phase): Output equation for single phase, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number of number of turns and conductor cross sectional area of primary and secondary windings, estimation of no load current, expression for leakage reactance and voltage regulation.

UNIT IV

DESIGN OF TRANSFORMERS(Three phase): Output equation for three phase transformers, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number turns and conductor cross sectional area of primary and secondary windings, estimation of no load current, expression for leakage reactance and voltage regulation. Design of tank and cooling tubes (round and rectangular).

UNIT V&VI

DESIGN OF INDUCTION MOTORS: Output equation, choice of specific loadings, main dimensions of three phase induction motor, stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, design of Rotor bars and end ring, design of Slip ring induction motor, estimation of No load current and leakage reactance, and circle diagram.

UNIT VII&VIII

DESIGN OF SYMCHRONOUS MACHINES: Output equation, choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non- salient pole synchronous machines. Design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, design of the field winding, and design of rotor of non- salient pole machine, Introduction to computer aided design.

Learning Resources

Text Books:

1. A course in Electrical Machine Design, A.K. Sawhney, Dhanpatt Rai & Sons.
2. Design of Electrical Machines, V.N. Mittle, 4th edition.

Reference Books:

1. Performance and Design of AC machines by M.G. Say, CBS publishers and Distributors pvt.Ltd.
2. Design Data Handbook, A.Shanmugasundarm, G,Gangadharam, R.Palani, Wiley Eastern Ltd.