



Semester –VI

Subject Name: Design of Electrical Machine and Equipment

Subject Code: 09EE2604

Diploma Branch in which this subject is offered: Electrical Engineering

Objective:

The aim of this subject is 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.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able

1. To understand need of design and aspects of design.
2. To design motor starter and motor control panels.
3. To design various electromagnets.
4. To design and calculate parameters of transformer.
5. To design and calculate parameters of induction motor.

Pre-requisite of course: DC circuit, AC circuit, electrical DC machine and transformer, electrical rotating AC machine.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
4	0	2	5	50	30	20	25	25	150

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	Fundamentals of electrical design <ul style="list-style-type: none"> • Introduction • What is electrical design • Need of designing of machine • Limitation of design of machine • Properties of material used to design machine Conducting material, insulating material and dielectric material. • Electrical machine affected by heating and cooling • Reason of heating in electrical machine 	9	16



	<ul style="list-style-type: none">• Different grade of insulating material and its effect• Specific electrical loading and specific magnetic loading• Factors on which the output of an electrical machine depends.• Parameters that affects size of machine		
2	Design parameters for motor accessories <ul style="list-style-type: none">• Introduction• Design parameter for chock• Design parameter for A.C. motor starter• Design parameter for D.C. motor starter• Calculation of resistance step, calculation for number of section and resistance of each section.• Design parameter for field regulator• Motor control panel design parameter	12	21
3	Electromagnet and transformer design parameter <ul style="list-style-type: none">• Introduction• What is electromagnet• Different types of electromagnets• Application of different electromagnet• Design different magnetic coils• Flat faced armature type circular magnet, horse shoe type magnet, plunger type magnet, magnetic clutches.• What is transformer• Specification of small transformer• Design parameters of transformer Design of core, design of winding, design of window area• Specification of distribution transformer and power transformer• Equations of transformer• Design parameter for three phase transformer Design of core, design of winding, design of window area, electrical parameters, design of tank• Steps to design a transformer	20	36
4	Induction motor design parameter <ul style="list-style-type: none">• Introduction• Specification of single-phase induction motor• Material used to design induction motor Insulator, conductor and core• Single phase induction motor design parameters Core dimension, Air gap, number of rotor slots, number of stator slots, main winding• Steps to design single phase induction motor• Specification of three phase induction motor• Three phase induction motor design parameters• Rating of motor, frame dimension, temperature rise,• Equation of three phase induction motor• L and D relation for better power factor• Steps to design three phase induction motor	15	27



Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
35%	35%	15%	15%	0%	0%

Suggested List of Practical/Exercise:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	Understand different insulating material used to design induction motor.	2
2	2	Design electrical panel for laboratory use.	4
3	2	Design starter for single phase induction motor.	4
4	3	Design horse shoe type magnet as per data provided.	4
5	3	Prepare report on steps of transformer designing.	2
6	3	Design single phase transformer as per data provided.	4
7	4	Design single phase induction motor considering data as per motor available in laboratory.	4
8	4	Design three phase induction motor considering data as per motor available in laboratory.	4

Instructional Method:

- The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- Show video or animation of working of various types of wiring system and electrical transmission and distribution network



References:

1. V. Rajini, “*Electrical machine design*”, Pearson India Education services pvt ltd, 2018
2. A. K. Sawney, “*Electrical machine design*”, Dhanpatrai & sons., latest edition.
3. Juha Pyrhonen, “*Design of rotating AC machine*”, John Wiley and sons, second edition, 2014.
4. R. K. Agrawal, “*Electrical machine design*”, S. K. Kataria & Sons, latest edition.
5. Alexander Gray, “*Electrical Machine Design; The Design and Specification of Direct and Alternating Current Machinery*”, Creative Media Partners, 2018.
6. J. B. Gupta, “*Electrical Installation, Estimating & Costing*”, S. K. Kataria & Sons, latest edition.

Supplementary Resources:

1. <https://www.explainthatstuff.com/electricmotors.html>
2. <https://www.elprocus.com/transformer-design>
3. <https://www.machinedesign.com/basics-design/ac-motors>
4. <https://www.oreilly.com/library/view/electrical-machine-design/9789353063740/xhtml/chapter004.xhtml>
5. <https://www.brighthubengineering.com/hvac/74957-starting-methods-for-induction-motors/>
6. <https://electronicsforu.com/electronics-projects/automatic-3-phase-induction-motor-starter>
7. <https://education.jlab.org/qa/electromagnet.html>