EE310: DESIGN OF ELECTRICAL APPARATUS
CREDITS = 5 (L=3, T=0, P=*2*)

Course Objectives:

1. To understand the design aspects of static and rotating AC & DC electrical machines.
2. To develop the creative Physical realization Electrical Machine concepts.
3. To perform specified tasks with Optimum economy and efficiency in Electrical Design.
4. **T**o make them competent with Computer aided design of electrical Machines.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	150
3	0	2	5	70	30	30	20	

Course Contents:

Unit No.	Topics	Teaching Hours
1	**GENERAL DESIGN ASPECTS:** Calculations of MMF for air gap and teeth; Real and apparent flux density; Field Form; Air gap flux distribution factor (field form factor); Magnetizing current calculation; Leakage Reactance calculation for various types of slots, Iron loss calculation concepts.	04
2	**DESIGN OF STARTERS AND FIELD REGULATORS:** Schematic diagrams of control circuit and power circuit for starters with contactors and timers. Design of starters and Field regulators.	06
3	**DESIGN OF ARMATURE WINDINGS:** **DC windings** : Simplex & Duplex windings; Lap & Wave windings; Applications; Basic terms related to armature windings; Dummy Coils; Equalizer connections; Split coils. **AC windings** : Introduction; No. of phases; Phase spread; Concentric winding, Hemitropic winding; Whole coil winding; Mush winding; Double layer windings; Integral slot lap and wave winding; Fractional slot lap and wave windings; Performance analysis of various windings.	06

Unit No.	Topics	Teaching Hours
4	**DESIGN OF TRANSFORMER:** Specification, Output equation of transformer, Volt per turn, Stacking factor, Ratio of iron loss to copper loss, Relation between core area and weight of iron and copper, Optimum designs, variation of output and losses in transformer with linear dimensions ,examples, Design of core, Choice of flux density and current density, Choice of window space factor, window dimensions, Design of yoke, Overall dimensions, examples, Design of high voltage and low voltage winding, examples, Estimation of operating characteristics: Primary & Secondary resistance, Leakage reactance of windings, Regulation, examples, Mechanical forces, No load current calculation, Change of parameters with change of frequency, Temperature rise of transformer, Design of tank, examples.	18
5	**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.	10
	TOTAL	**44**

List of References:

1. A.K.Sawhney & A.Chakrabarti, A course in Electrical machine design, Dhanpat Rai & Co.
2. Dr.N.K.Datta, Theory and practice of Electrical Machine Design,S.K.Kataria & sons,1st Edition 2016
3. V.N.Mittal & A.Mittal, Design of electrical machines, Standard Publishers distributors
4. Dr.J.G.Jamnani, Elements of electrical design, Mahajan publishing house, 5th Edition
5. M.G.Say, The performance and design of alternating current machines, CBS Publishers & Distributors
6. Juha Pyrhonen, Tapani Jokinen, Valeria Hrabovsova, Design of rotating electrical machines, Wiley publication

Course Outcomes (Cos):

At the end of this course students will be able to …

CO1: To Understand Design Aspects of Static and Rotating AC & DC Electrical Machine

CO2: To produce machines to Perform specified tasks

CO3: To make control and power circuit for starter

CO4: To learn the winding Design for AC & DC Machines

CO5: To understand Magnetic Circuit, Its parameters and Design

CO6: To Find out possible Extensions in the Design and Applications