4EE03: COMPUTER AIDED ELECTRICAL MACHINE DESIGN
CREDITS - 3 (LTP: 2, 0, 1)

Course Objective:
To explain the basic concepts of electrical machine design by using different computer optimization techniques.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
2	0	2	3	30	20	20	30	100

Details of Assessment Instruments under CE Practical Component:

Term work [20]	Allied Evaluation [10]
Presentations/Assignment/Design data/ Sketches	Performance/Quiz/ Questions & Answers/ Discussion

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.	03
2	**Design Of Starter, Field Regulators And Armature Winding:** Schematic diagrams of control circuit and power circuit for starters with contactors and timers, design of starters and field regulators **DC windings:** Simplex & duplex windings; lap & wave windings, basic terms related to armature windings; dummy coils; equalizer connections **AC windings:** Introduction, number of phases, Mush winding, double layer windings.	05
3	**Transformer Design:** Magnetic circuit specific electric and magnetic loadings selection, output equation, core and yoke sections, main dimensions design, core loss from design data, winding design, calculations of magnetizing current, winding	08

Unit No.	Topics	Teaching Hours
	resistances and leakage reactance's, losses, performance, temperature rise, cooling methods, radiators, tank wall dimensions.	
4	**Induction Motor Design:** Output equation, specific electrical and magnetic loading, main dimensions, selection of slots, stator design, stator slots, turns per phase, selection of air gap, unbalanced magnetic pull estimation, harmonic minimization, squirrel cage and wound rotor design, calculation of magnetic circuit, MMF calculations, stator teeth, stator core, effect of saturation, magnetizing current, no load current and its core loss component, leakage fluxes and reactance calculations, performance calculations - losses, efficiency, temperature rise, maximum torque from circle diagram.	08
5	**Computer Aided Design (CAD) of Electrical Machines:** Limitations and assumptions in traditional designs, need of CAD, analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Analytical design modules, 2D and 3D machine models, analyzing steady state and transient performance of the designs by different software.	04
	Total	**28**

List of References:

1. A .K .Sawhney – "A Course in Electrical Machine Design" 10th Edition, - Dhanpat Rai And sons New Delhi.
2. K. M. Vishnu, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
3. M Ramamoorty, "Computer-Aided Design Of Electrical Equipment", John Wiley & Sons
4. M. G. Say –The Performance and Design of A.C. Machines, 3rd Edition, CBS Publishers and distributors, Delhi, Reprint 2002.
5. R. K. Agarwal, "Principles of Electrical Machine Design", S. K. Kataria & Sons, Fifth Edition 2016, New Delhi.

Course Outcomes (COs):

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

1. Select proper commercial materials, their properties and selection criterions, IS standards used in electrical machine design.
2. Design commercial starter, armature winding, transformers and induction motors as per specifications.
3. Apply computer aided optimization techniques for design of electrical machines.