

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Electrical Machine Design (Professional Elective-II)
Course Code:	2ET1090604T
Pre-requisite Course:	Electrical Machines

Course Objectives:

1. The objective of the course is to understand the design fundamental concepts, design main dimensions & cooling systems of transformers.
2. To apply the correct methodologies to a design of the electrical machines.
3. To use Innovative tools and techniques will be used for the design optimization of the electrical machine.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Fundamentals of Machine Design: Major considerations in electrical machine design, Electrical engineering materials, Space factor, Choice of specific electrical and magnetic loadings, Thermal considerations, Heat flow, Temperature rise, Rating of machines.	06	15
2	Design of Transformers: Sizing of a transformer, Main dimensions, kVA output for single- and three-phase transformers, Window space factor, Overall dimensions, Operating characteristics, Regulation, No load current, Temperature rise in transformers, Design of cooling tank, Methods for cooling of transformers.	12	30
3	Design of Induction Motors: Sizing of an induction motor, Main dimensions, Length of air gap, Rules for selecting rotor slots of squirrel cage machines, Design of rotor bars & slots, Design of end rings, Design of wound rotor, Magnetic leakage calculations, Leakage reactance of polyphase machines, Magnetizing current, Short circuit current, Circle diagram, Operating characteristics.	10	20
4	Design of Synchronous Machines: Sizing of a synchronous machine, Main dimensions, Design of salient pole machines, Short circuit ratio, Shape of pole face, Armature design, Armature parameters, Estimation of air gap length, Design of rotor, Design of damper winding, Determination of full load field mmf, Design of field winding, Design of turbo alternators, Rotor design.	10	20
5	Computer aided Design (CAD): Limitations (assumptions) of traditional designs, Need for CAD analysis, Synthesis and hybrid methods, Design optimization methods, Variables,	07	15

	constraints and objective function, Problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.		
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Text Books:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 6th edition-2018.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London, 4th edition-2012.

Reference Books:

1. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2012.
2. K. L. Narang, "A Text Book of Electrical Engineering Drawings", Satya Prakashan, 2nd edition-2016.
3. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications.
4. A. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 3rd edition-2014.
5. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

ICT/MOOCs Reference:

1. <https://nptel.ac.in/courses/108105155/>
2. <https://nptel.ac.in/courses/108106023/>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the construction and performance characteristics of electrical machines.	2 Understanding
CLO2	Identify the various factors that influence electrical machine design parameters.	2 Understanding
CLO3	Use appropriate technology to accomplish design calculations.	3 Applying

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H	H	H	H		L	M	M	M		L	M	H	L	M	L
CLO2	H	H	H	H	M	H	L	M	M		L	M	H	H	H	
CLO3	H	H	H	M	M	L			L		M	L	H	H	M	L

H: High, M: Medium, L: Low