

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Department Elective-III: Special Electrical Machines
Course Code:	1ET1090709
Pre-requisite Course:	Fundamental Knowledge of Electrical Machine is required.

Course Objectives:

1. Student will learn about the operating principal and construction of different Special Electrical Machine.
2. Student aware about the detail close loop operation of different Special Electrical Machine.
3. Student will know the different application of each Special Electrical Machine.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)								
Lecture	Tutorial	Practical	Credit	Theory				Practical				Total
				University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	-	-	3	28	70	12	30	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Permanent Magnet Brushless D.C. Motor Types of Permanent Magnet and its properties, Brushless DC Machines construction and working principle, Electronics communication, Type of BLDC motor: Interior rotor and Exterior rotor BLDC, Trapezoidal and Sine BLDC, Six step operation of BLDC, Comparison between the axial and radial permanent magnet motors, 60° and 120° Operation of BLDC, Close loop speed control of PMBLDC drive, Applications.	12	30
2	AC Servo Motor Construction, Principle of operation, Characteristics, Types of servo motors, Applications.	04	10
3	Permanent Magnet Synchronous Machines: Construction and working principal of PMSM, EMF and torque equations, 120° and 180° operation of PMSM, Power Converter, Torque-Speed characteristics, Close Loop Control of PMSM drive, Control Strategies of PMSM, Application of PMSM.	12	30
4	Stepping Motors: Constructional features, Principle of operation, Variable reluctance stepper motor, Hybrid stepper motor, Single and multi-stack configurations, Theory of torque predictions, Linear and non-linear analysis, Torque-speed characteristics, Drive circuits.	12	30

Reference Books:

1. D. C. Hanselman, "Brushless Permanent-Magnet Motor Design, 2nd edition, 2016".
2. T.J.E Miller, "Brushless permanent magnet and reluctance motor drives", Clarendon Press, Oxford, 2012.
3. E.G. Janardanan, "Special Electrical Machine", PHI Publication, 2014.
4. Simmi P. Burman, "Special Electrical Machines", Kataria and Sons, 2013.
5. Jacek Gierasewing, "P. M. Motor Technology", Marcel Dekker, 2012.
6. Ned Mohan, "Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB, 2009.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand constructional aspects, operational aspects, characteristic and control of different special electrical machines.	2 Understanding
CLO2	Analyze special electrical machines with an insight in to its applicability.	4 Analyzing
CLO3	Understand characteristics and applications of permanent magnet material.	2 Understanding
CLO4	To acquire the knowledge on construction and operation of permanent magnet synchronous motors.	1 Remembering
CLO5	To select a special Machine for a particular application.	4 Analyzing
CLO6	Knowledge about construction, principle of operation of switched reluctance motors.	1 Remembering

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		M			L				M	L		L				L
CLO2	L		H			L					L	H			M	L
CLO3		L		M			M		M					L		
CLO4			L					L		M			M			
CLO5					M									L	L	
CLO6		L				M										

H: High, M: Medium, L: Low