

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Special Electrical Machines (Professional Elective-II)
Course Code:	2ET1090607T
Pre-requisite Course:	Electrical Machines.

Course Objectives:

1. The objective of the course is to understand constructional aspects, operational aspects, characteristic and control of different advanced electrical machines.
2. Apply knowledge of the latest developments to enhance the design and performance of electric motor systems.
3. Assess the efficiency, characteristics, and control strategies for different special electrical machines.

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	Switched Reluctance Motors: Constructional features, Types of SRMs, Principle of operation, Torque production, Power controller, Steady state performance prediction, Analytical method, Power converters and their controllers, Methods of rotor position sensing, Sensor less operation, Closed loop control of SRM, Torque-speed characteristics.	07	15
2	Permanent Magnet D.C. Motors: Principle of operation, Magnetic circuit analysis, Permanent magnet materials, Magnetic characteristics, Permeance coefficient, EMF and torque equations, Commutation, Power controllers, Motor characteristics and control.	07	15
3	Servo Motor: Construction, Principle of operation, Characteristics, Types of servo motors, Applications.	03	08
4	Permanent Magnet Synchronous Machines: Principle of operation, EMF and torque equations, Reactance, Phasor diagram, Power controllers, converter, Volt-ampere requirements, Torque speed characteristics, Armature reaction MMF, Synchronous reactance, Sine wave motor with practical windings.	08	15
5	Stepping Motors: Constructional features, Principle of operation, Variable reluctance motor, Hybrid motor, Single and multi-stack configurations, Theory of torque predictions, Linear and non-linear analysis, Torque speed characteristics, Drive circuits.	06	15

6	Universal Motor: Construction, Principle of operation, Characteristics, Speed control methods, Applications.	02	07
7	Brushless Direct Current Motors: Construction of brushless direct current motors, Comparison between brushless direct current motors and permanent magnet synchronous motors, Driving principle of brushless direct current motors, Voltage equations and torque equation, Control of brushless direct current motors, PWM techniques.	07	15
8	SyRM: Construction of SyRM, Working of SyRM, Control of SyRM, Constant direct axis current control of SyRM.	05	10

Text Books:

1. Mukherjee and Chakravorty, "Electrical Machines", Dhanpat Rai Pub., New Delhi, 6th edition-2018.
2. T.J.E Miller, "Brushless permanent magnet and reluctance motor drives", Clarendon Press, Oxford.
3. Sang-Hoon Kim, "Electric Motor Control: DC, AC, and BLDC Motors", Elsevier Science, 4th edition-2018.

Reference Books:

1. Nagrath and Kothari, "Electric Machines", TMH, New Delhi, 6th edition-2009.
2. M. G Say, "The performance and design of alternating current machines", CBS Publishers and Distributors, 4th edition-2004.
3. Fitzgerald, Kingsley and Umans "Electric Machinery": TMH, New Delhi.
4. P. S Bimbhra, "Electrical Machinery", Khanna Pub., Delhi.
5. V. V. Athani, "Stepper Motors: Fundamentals, Applications and Design", New Age International Pvt. Ltd, 2nd edition-2018.
6. V.K.Gaudani, "Energy Audit and Energy Management", Vol-I, IECC Press.
7. William H. Yeadon, Alan W. Yeadon, "Handbook of small electric motors", McGraw- Hill, 5th edition-2015.
8. A K Theraja & B L Thereja, "A Text book of Electrical Technology (Vol II)", S Chand & Co, 4th edition-2006.

ICT/MOOCs Reference:

1. <https://nptel.ac.in/courses/108104140/>
2. [https://nptel.ac.in/content/storage2/courses/108105063/pdf/L-35\(SM\)%20\(IA&C\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/content/storage2/courses/108105063/pdf/L-35(SM)%20(IA&C)%20((EE)NPTEL).pdf)
3. <https://nptel.ac.in/courses/108/102/108102156/>

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 advanced electrical machines.	2 Understanding
CLO2	Analyze advanced electrical machines with an insight in to its applicability.	4 Analyzing
CLO3	Apply knowledge of the latest developments to enhance the design and performance of electric motor systems.	3 Applying

CLO4	Implement control strategies, power converters, and drive circuits for different motor configurations in practical scenarios.	3 Applying
CLO5	Assess the efficiency, characteristics, and control strategies for different special electrical machines.	5 Evaluating

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

H: High, M: Medium, L: Low