GUJARATTECHNOLOGICALUNIVERSITY

ProgramName: Master of Engineering

Level: PG

Subject Code: ME02000671

Course / Subject Name: Advanced Electrical Drives.

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the	Professional Elective

Prerequisite:	NA
Rationale:	Advanced Electric Drives is an essential subject for students in Power Electronics Engineering, focusing on the control and operation of advanced electric motors in complex, high-performance applications.This subject prepares students to implement high-performance and energy-efficient drive systems for sustainable technological advancements.

Course Outcome:

After Completion of the Course, the student will be able to :

No	Course Outcomes
01	Illustrate the concepts of Energy efficient motor for Electric drive systems.
02	Evaluate and choose the appropriate motor power rating for specific electric drive applications.
03	Select suitable drive with control strategy for specific application.
04	Identify applications of electric drives in industry.

Teaching and Examination Scheme:

Teaching Scheme (inHours/Week)			Total Credits (L+T+(PR/2))	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial /Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Energy Conservation in Electrical Drives:** Standard motor efficiency, concept of Energy efficient motor, Efficiency evaluation technique, Direct Measurement method, Loss in Electric Drive System, Segregation method, Comparison, motor efficiency labeling, Energy efficient motor standards, Motor life cycle, Direct Savings and pay back analysis, Efficiency evaluation factor, Improvement of Power Factor, Quality of Supply, Harmonics Reduction and mitigation technique.	7	15
2.	**Motor Power Rating Selection and Load Diagram:**General considerations in selecting motor power ratings, continuous duty cycle, short time duty cycle, Intermittent duty cycle, Insulation classes, Motor heating and cooling under various duty cycles, Selection of motor	7	15

	power capacity, equivalent current, torque and power methods, Load diagrams, Applications.		
3.	**Synchronous Motor Drive:**Introduction, Synchronous motor and its characteristics, Control strategies, Open loop voltage source inverter (VSI) fed drive and its characteristics, Self-control, Torque angle control, Power factor control, constant flux control, Brushless excitation systems, Field oriented control, Load commutated inverter fed synchronous motor drive, motoring and regeneration, current source inverter (CSI) fed synchronous motor, Closed loop operation of Synchronous motor drive systems, Cyclo-converter fed Synchronous Motor, Applications.	8	20
4.	**Switched Reluctance Motor Drive:**Introduction, Construction and working of Switched reluctance motor(SRM), Stator Excitation, Torque characteristic, Flux characteristics, Control techniques, Voltage impulse control, current control, torque control, Torque Ripple, Instantaneous Torque control using current controllers, flux controllers, Converters for switched reluctance machine, Eight switch asymmetrical converter, Six switch converter for SRM drive, Variable dc link converter, Buck-boost converter, Torque controlled SRM, SRM drive with speed/position sensor, Direct Torque Control of SRM Drive, Sensor-less Control of SRM Drives, linear switched reluctance motor, Applications.	9	20
5.	**Synchronous Reluctance Motor Drive:**Constructional features and working principle of Synchronous Reluctance Motor, Torque equation, Phasor diagram, Types of Synchronous Reluctance Motor, Characteristics, Control Strategies and Important Parameters, Block diagram of Synchronous reluctance Drive System, Advantages and disadvantages, Applications of Synchronous Reluctance Motor, Applications.	8	15
6.	**Traction drives:**Electric traction services, Nature of traction load, Main line and suburban train configurations, Calculations of traction drive rating and energy consumption, Important features of Traction Drives, Traction motors, Conventional dc and ac traction drives, 25 kV ac traction using semiconductor converter controlled dc motors, Poly-phase ac motors for traction drives, dc traction employing poly-phase ac motors, ac traction employing poly-phase ac motors.	8	15
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
40	20	20	20	0	0

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(asperRevisedBloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
2. P.C. Krause, O. Wasynczuk and S.D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.
3. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.
4. Muhammad H. Rashid, "Power Electronics Handbook: Devices, Circuits and Applications", 2nd Edition, Academic Press, 2010
5. Gopal K. Dubey, "Fundamentals of Electrical Drives", 2nd Edition, Alpha Science, 2001.
6. John C. Andreas, Energy efficient electric motors, Marcel Dekker Inc. 1992.

(b) Open-source software and website:

1. https://nptel.ac.in/

SuggestedCoursePracticalList:

This is a suggestive list only. The subject teacher can change the list according to availability of resources.

1. Simulation of Switched Reluctance motor control.
2. Simulation of Synchronous Motor Control
3. Heating cooling curves for various duty cycles.
4. Simulation of Synchronous reluctance motor.
5. Selection of motor for application.

ListofLaboratory/LearningResourcesRequired:

1. PC/Laptop with installed MATLAB/ similar software
2. E-materials available at the website of NPTEL- http://nptel.ac.in/

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