PROGRAMME ELECTIVE COURSE VERTICALS FOR HONOURS / MINOR DEGREE

VERTICAL II : POWER CONVERTERS AND DRIVES

22EEHO201	ANALYSIS OF ELECTRICAL MACHINES		SEMESTER			
PREREQUISITES		CATEGORY	PEC	Credit		3
		Hours/Week	L	T	P	TH
DC Machines , Synchronous and Induction Machines			2	0	2	4

Course Objectives:					
1.	To model & simulate all types of DC machines				
2.	To develop reference frame equations for various elements like R, L and C				
3.	To model an induction (three phase and 'n' phase) and synchronous machine				
4.	To drive reference frame equations for induction and synchronous machine				
5.	To study the need and working of multiphase induction and synchronous machine				
UNIT I	**MODELING OF BRUSHED-DC ELECTRIC MACHINERY**	**6**	**0**	**6**	**12**
Fundamentals of Operation – Introduction – Governing equations and modeling of Brushed DC-Motor – Shunt, Series and Compound – State model derivation – Construction of Model of a DC Machine using state equations- Shunt, Series and Compound.					
UNIT II	**REFERENCE FRAME THEORY**	**6**	**0**	**6**	**12**
Historical background – phase transformation and commutator transformation – transformation of variables from stationary to arbitrary reference frame .					
UNIT III	**INDUCTION MACHINES**	**6**	**0**	**6**	**12**
Three phase induction machine - equivalent circuit– free acceleration characteristics – voltage and torque equations in machine variables and arbitrary reference frame variables – Simulation under no load and load conditions- Machine variable form, arbitrary reference variable form.					
UNIT IV	**SYNCHRONOUS MACHINES**	**6**	**0**	**6**	**12**
Three phase synchronous machine - voltage and torque equations in machine variables and rotor reference frame variables (Park's equations).					
UNIT V	**MULTIPHASE (MORE THAN THREE-PHASE) MACHINES CONCEPTS**	**6**	**0**	**6**	**12**
Preliminary Remarks - Necessity of Multiphase Machines - Evolution of Multiphase Machines- Advantages of Multiphase Machines - Working Principle - Multiphase Induction Machine, Multiphase Synchronous Machine - Modeling of 'n' phase machine. Applications of Multiphase Machines					
LAB COMPONENT					
1	Modeling of DC machines.				
2	Simulation under no-load and loaded conditions for a PMDC motor				
3	Simulation of smooth starting for DC motor.				
4	Simulation under no-load and load conditions of a three phase induction machine in machine variable form and arbitrary reference variable form				
5	Simulation under no-load and load conditions of a three phase synchronous machine in machine variable form and arbitrary reference variable form.				
					Total (30L+0T+30P)= 60 Periods

Test Books:	
1.	Stephen D. Umans, "Fitzgerald & Kingsley's Electric Machinery", Tata McGraw Hill, 7th Edition, 2020.
2.	Bogdan M. Wilamowski, J. David Irwin, The Industrial Electronics Handbook, Second Edition, Power Electronics and Motor Drives, CRC Press, 2011, 1st Edition.
3.	Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Steven D. Pekarek, "Analysis of Electric Machinery and Drive Systems", 3rd Edition, Wiley-IEEE Press, 2013..
4.	Chee Mun Ong, Dynamic Simulation of Electric Machinery using MATLAB, Prentice Hall, 1997, 1st Edition
5.	Atif Iqbal,Shaikh Moinoddin, Bhimireddy Prathap Reddy, Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK, Wiley,2021,1st Edition

Reference Books	
1.	R. Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Pearson Education, 1st Imprint, 2015, 1st Edition.
2.	R.Ramanujam, Modeling and Analysis of Electrical Machines, I.k.International Publishing House Pvt.Ltd,2018.

Course Outcomes: Upon completion of this course, the students will be able to:			**Bloom's Taxonomy Mapped**
CO1	:	Find the modeling for a brushed DC-Motor (Shunt, Series, Compound and separately excised motor) and to simulate DC motors using state models	L1: Remembering
CO2	:	Apply reference frame theory for, resistive and reactive elements (three phase)	L2: Understanding
CO3	:	Compute the equivalent circuit and torque of three phase induction motor and synchronous motor in machine variable arbitrary reference frame variable	L5: Evaluating
CO4	:	Demonstrate the working of multiphase induction and synchronous machine.	L3: Applying
CO5	:	Compute the model of three phase and multiphase induction and synchronous machine.	L6: Creating

COURSE ATTRICULATION MATRIX

COs/ Pos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3		2	1		3		3	3	3
CO2	3	3	3	3	3		2	1		3		3	3	3
CO3	3	3	3	3	3		2	1		3		3	3	3
CO4	3				3		2	1		3		3	3	3
CO5	3				3		2	1		3		3	3	3
Avg	3	3	3	3	3	0	2	1	0	3	0	3	3	3

3/2/1-indicates strength of correlation (3- High, 2-Medium, 1- Low)