Course Number and Name

BEE**052 &** Electrical Machine Modeling and Analysis

Credits and Contact Hours

3 & 45

Course Coordinator's Name

Mrs.Anithasampath Kumar

Text Books and References

Text Books:

1. R. Krishnan, "Electric Motor Drives - Modeling, Analysis& control", Pearson Publications, First edition, 2002.
2. P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff, "Analysis of Electrical Machinery and Drive systems", IEEE Press, Second Edition.

References:

1.P.S.Bimbra, "Generalized Theory of Electrical Machines" Khanna publications, Fifth edition - 1995.

2. Chee Mun Ong –"Dynamic simulation of Electric machinery using MATLAB / Simulink", Prentice Hall of India Publications
3. Online courses on Modeling of Electrical Machines -http://nptel.ac.in/courses/108106023/

Course Description

To master the various fundamentals, machine design, machine modeling of various types of electrical machines. This will help you to gain knowledge and to do research in the area of electrical machine modeling.

Prerequisites	**Co-requisites**
Electrical Machines Design	Nil

required, elective, or selected elective (as per Table 5-1)

Required

Course Outcomes (COs)

CO1: To learn about the basic concepts of AC/ DC machine modeling.
CO2: To study about the dynamic modeling and phase transformation
CO3: To analyze various methodologies in small signal machine modeling.
CO4: To understand the modeling of synchronous machine modeling.
CO5: To learn the performance and dynamic modeling of synchronous machines

Student Outcomes (SOs) from Criterion 3 covered by this Course

COs/SOs	a	b	c	d	e	f	g	h	i	j	k	l
CO1		H	M	M	M	M	M	L	M	M	L	M
CO2		H		M	H	M	M	L	M	M	L	M
CO3	H	H							M	M		
CO4	H		M			H	M			M		H
CO5	H	H	M	H	H	H	M	M	M	M	L	M
CO6		H	M	M	M	M	M	L	M	M	L	M

List of Topics Covered

UNIT I BASIC CONCEPTS OF MODELING 9

Basic Two - pole Machine representation of Commutator machines, 3 phase synchronous machine with and without damper bars and 3 - phase induction machine, Kron's primitive Machine - voltage, current and Torque equations. DC Machine modeling: Mathematical model of separately excited D.C motor –Steady State analysis - Transient State analysis - Sudden application of Inertia Load - Transfer function of Separately excited D.C Motor - Mathematical model of D.C Series motor, Shunt motor - Linearization Techniques for small perturbations

UNIT II REFERENCE FRAME THEORY 9

Reference frame theory Real time model of a two phase induction machine-Transformation to obtain constant matrices - three phase to two phase transformation - Power equivalence. Dynamic modeling of three phase Induction Machine Generalized model in arbitrary reference frame - Electromagnetic torque - Derivation of commonly used Induction machine models - Stator reference frame model - Rotor reference frame model Synchronously rotating reference frame model -Equations in flux linkages - per unit model

UNIT III SMALL SIGNAL MODELING 9

Small Signal Modeling of Three Phase Induction Machine Small signal equations of Induction machine – derivation - DQ flux linkage model derivation - control principle of Induction machine. Symmetrical and Unsymmetrical 2 phase Induction Machine Analysis of symmetrical 2 phase induction machine - voltage and torque equations for unsymmetrical 2 phase induction machine - voltage and torque equations in stationary reference frame variables for unsymmetrical 2 phase induction machine - analysis of steady state operation of unsymmetrical 2 phase induction machine - single phase induction motor - Cross field theory of single - phase induction machine.

UNIT IV MODELING OF SYNCHRONOUS MACHINE 9

Synchronous machine inductances – voltage equations in the rotor's dq0 reference frame - electromagnetic torque - current in terms of flux linkages - simulation of three phase synchronous machine- modeling of PM Synchronous motor.

UNIT V DYNAMIC ANALYSIS OF SYNCHRONOUS MACHINE 9

Dynamic performance of synchronous machine, three -phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria.