DYNAMICS OF ELECTRICAL MACHINES
(ELECTIVE-II)

Course Code: 13EE2213 **L P C**
4 0 3

Pre requisites: Electrical Machines

Course Educational Objectives:
To impart the students with dynamic modeling, simulation and control theory for electric machinery and associated power electronic drive systems that find a wide range of applications in electric power engineering careers

Course Outcomes:
At the end of the course, a student will be able to**:**

1. Derive Kron's Primitive machine as an unified electrical machine model
2. Derive the mathematical model and control a 3- phase Induction motor
3. Analyze asymmetrical 2-phase induction motor
4. Derive the mathematical model of a separately excited DC motor and DC Series motor
5. Analyze a three phase synchronous machine under transient conditions

UNIT-I: MODELING CONCEPTS
Basic Two-pole machine representation of commutator machines, 3-ph
synchronous machine with and without damper bars and 3-ph induction machine, Kron's primitive machine-voltage, current and torque
equations. Real time model of a two phase induction machine-transformation to obtain constant matrices-thee phase to two phase transformation- power equivalence.

UNIT-II 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 frame model- Equations in flux linkages - per unit model-Dynamic Simulation- Small signal equations of induction machine –

derivation DQ flux linkage model derivation – control principle of Induction machine.

UNIT-III

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 SYNCHRONOUS MACHINE MODELING

Mathematical model of a sep. excited DC motor- steady state and transient analysis - Transfer function of a sep. excited DC motor – Mathematical model of a DC series motor, shunt motor-linearization
techniques for small perturbations. Synchronous machine inductances – voltage equations in the rotor's DQ0 reference frame- electromagnetic
torque-current in terms of linkages.

UNIT-V DYNAMIC ANALYSIS OF SYNCHRONOUS MACHINE

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

TEXT BOOKS:

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

REFERENCES:

1. Chee Mun Ong "*Dynamic simulation of Electric machinery using Matlab / Simulink*" – Prentice Hall,2000

2. D.P.Sengupta &J.B.Lynn :"*Electrical Machine Dynamics*",The Macmillan Press Ltd.
3. C.V. Jones :"*The Unified Theory of Electrical Machines*" Butterworth, London.
4. Woodson & Melcher, "*Electromechanical Dynamics*", John Wiley & Sons.