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IV Year B. Tech EEE II - Semester

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### ELECTRICAL MACHINE MODELING & ANALYSIS

(Professional Elective -VI)

Prerequisites: Electrical machines.

#### Course Objectives:

1. To acquire the knowledge of generalized theory of electrical machines.
2. To represent the DC and AC machines as Basic Two Pole machine.
3. To model the electrical machines with voltage, current, torque and speed equations.
4. To investigate the steady state behavior of the electrical machines.

#### UNIT - 1: (~9 Lecture Hours)

Basic concepts of Modeling - Basic Two-pole Machine representation of DC machines, 3-phase synchronous machine and 3-phase induction machine, Kron's Primitive 2- axis Machine -voltage, current and Torque equations.

#### UNIT - II: (~9 Lecture Hours)

DC Machine Modeling: Mathematical model of separately excited D.C motor , D.C Series motor, D.C Shunt motor and D.C. Compound motor in state variable form, Transfer function of the motor - Numerical problems.

#### UNIT- III: (~9 Lecture Hours)

Liner transformation: Phase transformation (a, b, c to  $\alpha, \beta, 0$ ) - Active transformation ( $\alpha, \beta, 0$  to d, q), Circuit model of a 3 phase Induction motor - Linear transformation - Phase Transformation -Transformation to a Reference frame - Two axis models for induction motor.

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#### UNIT - IV: (~9 Lecture Hours)

Modeling of three phase Induction Machine: Voltage and current Equations in stator reference frame - equation in Rotor reference frame - Equations in state - space form, Torque equation .

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#### UNIT -V: (~9 Lecture Hours)

Modeling of Synchronous Machine: Two axis representation of Synchronous Motor, Synchronous machine inductances -voltage equations in the rotor reference frame - Torque equation.

16) *R. Balasubramanian*

1) N. Madhukar 5)

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### Text Books:

1. P.S.Bhimbra – “Generalised theory of Electrical Machines”- Khanna publishers - 6<sup>th</sup> Edition- 1981.
2. P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff – “Analysis of Electrical Machinery and Drive systems”- -IEEE Press -3<sup>rd</sup> Edition – 2013.
3. Chee Mun Ong – “Dynamic simulation of Electric machinery using Matlab / Simulink “ -Prentice Hall – 1998.

### Reference Books:

1. R.Krishnan - “Electric Motor Drives - Modeling, Analysis& control “- Pearson Publications- 1<sup>st</sup> Edition -2015.
2. Vedam Subramanyam – “Thyristor control of Electric Drives “- Tata McGraw-Hill Education, 2011.

**Course Outcomes:** After completion of this course the students will be able to:

1. Apply knowledge of behavior of DC motors to model and analyze for different applications.
2. Analyze the characteristics of different types of DC motors to design suitable controllers.
3. Acquire knowledge of reference frame theory for AC machines.
4. Evaluate the steady state and transient behavior of induction and synchronous machines to propose the suitability of drives for different industrial applications.
5. Analyze the 2-Phase induction machines using voltage and current equations to differentiate the behavior and to propose their applications in real world.
6. Apply knowledge of 2- axis concept to obtain torque equation of Induction and synchronous motors.

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2) Dr. Subbalakshmi

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4) S. Sankar

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