IV Year B.Tech. EEE II - Semester

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EE424 MACHINE MODELLING AND ANALYSIS
(Dept. Elective - VI)

Course Description & Objectives:

The student learns the mathematical modeling of electrical machines.

Course Outcomes:

- *Able to explain modeling of DC and AC Machines.*
- *Able to explain conversions from single phase to Three Phase system.*
- *Able to write dynamical equations of AC and DC Machines.*
- *Able to analyze transient performance of machines.*

UNIT I - Elements of generalized theory:

Essentials of rotating electrical machines-conventions-Basic two pole machine-representation of DC and three phase AC machines-Transformer and speed voltages in the armature – Kron's primitive machine – voltage equations – expression for power – Torque.

UNIT II - Linear Transformations:

Linear transformations in machines - invariance of power - Transformation from a displaced brush axis – Transformation from three phases to two phases (a,b,c to a,b,0)-power invariance –transformation from rotating axes (a,b,0) to stationary axes (d,q,0) – park's transformation – physical concepts.

UNIT III - Mathematical Models of DC Machines:

Mathematical model of separately excited, series, shunt and compound DC motors transfer functions of separately excited DC motor – equations in state variable form computation of dynamic characteristics.

UNIT IV - Mathematical Models of Three Phase Induction Motor:

Circuit model-winding inductances-flux linkages-voltage equations-transformation to equivalent two phase representation – equations in the stator frame – equations in rotor reference frame - equations in synchronously rotating frame – expression for Torque – equations in state variable form – equations for sinusoidal voltages – equivalent circuit of the induction motor.

UNIT V - Mathematical Models of Synchronous Motor:

Synchronous motor – circuit model of a three –phase synchronous motor – winding inductances – flux linkages voltage equations – parks transformation to d,q,0 variables – direct and quadrature – axes synchronous inductances and zero sequence inductance – voltage equations in steady state and phasor representation – expression for Torque power angle characteristic of salient pole motor.

TEXT BOOKS:

1. Vedam Subramanyam, “Thyristor control of Electric Drives”, 1st ed., TMH, 2002.
2. Paul C.Krause, Oleg wasynezuk, Scott D. Sudhoff “Analysis of electric machinery and Drive systems”, 2nd ed., John Wiley, 2004.