

## PPE103 ANALYSIS OF MACHINE DRIVES

L T P Cr

3 1 0 3.5

**Course Objectives:** To impart knowledge about fundamentals of Electric drives and control operational strategies of dc and ac motor drives as per different quadrant operations and to discuss the modeling and control of dc motor drive, ac motor drives and permanent magnet machines.

**BASICS OF ENERGY CONVERSION IN DRIVES:** General expression of stored magnetic energy, Concepts co-energy and development of force/torque in single and doubly excited electro-mechanical system, Determination of air gap mmf and per phase machine inductance using physical machine data, Voltage and torque equation of DC machine, Three phase symmetrical induction machine and salient pole synchronous machines in phase variable form, Switching and surge voltage transients in transformers.

**INTRODUCTION TO REFERENCE FRAME THEORY:** Static and rotating reference frames, Transformation model relationships with static symmetrical three phase circuits, Application of reference frame theory to three phase symmetrical alternating current machines. State Space Modelling.

**DYNAMIC MODELS:** Dynamic direct-axis and quadrature-axis model in arbitrarily rotating reference frames, Voltage and torque equations, Derivation of steady state phasor relationship from dynamic model, Comparison of generalized theory of rotating electrical machine and Kron's primitive machine.

**DETERMINATION OF DYNAMIC EQUIVALENT CIRCUIT PARAMETERS:** Standard and derived machine time constants, Analysis and dynamic modelling of two phase asymmetrical induction machine and single phase induction machine, Linearized and non-linearized analysis; Operation on harmonic supplies, Unbalanced operation of three-phase machine.

**PERMANENT MAGNET SYNCHRONOUS MACHINE:** Trapezoidal and sinusoidal back emf type, Surface permanent magnet and interior permanent magnet machines, Construction, Operating principle and its characteristics, Dynamic modeling and self controlled operation of BLDC & PMSM.

**SWITCH RELUCTANCE MOTORS:** Analysis and design trade-off, Basic operating characteristics. Different control topologies of SRM

**Course Learning Outcome:** On the completion of the course, the student will be able

- To acquire the knowledge of selection of drives as per practical operational industrial requirement.
- To apply their knowledge to prepare control schemes as per different types of motors used in industries.
- To estimate & solve harmonic and power factor related problems in controlling AC and DC drives

### Recommended Books

1. Bimbhra, P.S., *Generalized Theory of Electric Machines*, Khanna Publishers (2006).
2. Krause, P. C., Wasynczuk, O. and Sudhoff, S. D., *Analysis of Electric Machinery and Drive Systems*, Wiley IEEE Press (2002).
3. Bose B.K., *Modern Power Electronics Control and AC Drives*, Prentice Hall, 2<sup>nd</sup> ed., (2001)

### Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes etc.)	25