

Electromechanics (EEL 203) (template awaited)

Outline of Course Contents for Electromechanics

Magnetic Circuits- Simple magnetic circuit, analogy between magnetic circuits and electrical circuits, linear and nonlinear magnetic circuits, hysteresis and eddy current losses, permanent magnet materials.

Transformers: Single Phase transformers, equivalent circuit, determination of transformer equivalent circuit parameters using open circuit, short circuit tests, regulation, per unit system, efficiency, condition of maximum efficiency, conditions for parallel operation, auto transformers, Three Phase transformers- connections as star/star, star/delta, delta/delta and delta/star connected three-phase transformers. Special Multiphase Transformers- Phase conversion, Scott connection, Three phase to six phase connection, tap-changing transformers.

Electro-Mechanical Conversion: Principle of conservation of energy; energy balance equation, forces and torque in magnetic field systems, energy in singly-excited magnetic systems and multiple excited magnetic field systems. Force and torque in electro-mechanical systems-principle of virtual work, mechanical force in singly excited linear systems, and reluctance torque in rotating machines, torque in multiply excited magnetic systems.

DC Machines: Principle of emf and torque production- commutator action, energy conversion through electromagnetic field, Armature windings, DC Generators types, DC Motors- shunt, series, cumulative and differential compound excited motors, speed control of DC motors starting of DC motors, losses, efficiency, maximum efficiency.

Synchronous Machines: Salient pole and cylindrical types, Synchronous Generators, voltage regulation, Characteristics, determination of synchronous impedance by OC and SC tests, capability curve, parallel operation of generator. Park's d-q-0 transformation. Synchronous motors- V-curves, inverted V-curves, O-curves, losses and efficiency.

Induction Machines: working, cage and slip ring rotors, equivalent circuit, determination of circuit parameters, no-load, blocked rotor and synchronous speed test, torque speed characteristics, starting and braking methods, speed control methods. Induction Generators- self excited induction generators, and Doubly Fed Induction Generators.

Fractional kW Machines: Single phase induction motors: methods of starting -split phase, shaded pole, capacitor start, capacitor run, capacitor start and capacitor run, performance characteristics. Reluctance motors, Hysteresis motors, Universal motors.

Special Purpose Machines: Permanent magnet brushless DC machines. Permanent magnet Synchronous machines, Switch Reluctance machines, Stepper motors, Linear Motors.