ELG2336: DC Motors

- Convert electrical energy to mechanical work.
- Apply voltage across its terminals to provide a direct current to the motor.
- Often packaged with gearboxes and/or encoders.
- It has several configurations including separately-excited, series, parallel, series and parallel, and permanent magnet.

Question

Draw the equivalent circuits (electromechanical models) for separatelyexcited, series, and parallel DC motors.

Underlying Physics

Faraday's Law:

States the relationship between time-varying magnetic fields and induced voltages in circuits. One of this law's corollaries describes how mechanical forces arise when current-carrying wires are in magnetic fields.

Lorentz Law:

Consider a wire of length L carrying a current I in a magnetic field of strength B. A force will be induced on this wire, perpendicular to I and B, with a value:

 $\mathbf{F} = \mathbf{I} \mathbf{x} \mathbf{L} \mathbf{x} \mathbf{B}$ (F in Newtons; I in Amperes; L in meters; B in Tesla).

Question: Show Lorentze law in a sketch

Mechatronics Configuration

Configuration

- Place two magnets to create constant B field.
- Place wire loop that rotates about the zero axis between the magnets and run current through wire loop.

Results

- Forces created on primary wire segments
- Results in torque on loop about zero axis.
- As loop turns, must reverse the current direction every 180°.
- To solve this matter, use mechanical commutator with brushes.

Question: Draw the above case in a sketch.