

# ECE 763

## Homework #6

### Problems:

1. Calculate the response of the U12M4T motor (that is, an equation for the output velocity  $\dot{\theta}$  as a function of time) for a 1 volt step of input voltage with (a)  $L = 0$  and (b)  $L = 100 \mu\text{h}$ . For both parts, assume that  $|\tau_f| = 0$ .

Assume zero initial conditions. What is value of the velocity for each of the two cases at  $t = 1/60 \text{ sec.}$ ? at  $t = 1 \text{ sec.}$ ?

Does the inductance affect the response to any significant degree? Explain.

2. For the push-pull amplifier given in class, what are the voltage and current supplied at the output of the MC1533 op-amp when the output voltage and current are 5 volts and 3 amps, respectively? Assume  $V_{BE}(\text{active}) = 0.7 \text{ volts}$  and  $\beta_F = 100$ .
3. Find the parameters for a permanent magnet DC motor.
  - (a) The motor is tested as follows. With a constant voltage of 15 volts applied, and stalled, the motor draws 5 amps. When rotating at 50 rad/sec, the motor draws 1 amp. Find the effective armature resistance and the back EMF constant,  $K_b$ .
  - (b) The motor, when stalled, draws 5 amps and exerts 1 ft-lb of torque. Find  $K_\tau$ .
  - (c) The motor is presented with a voltage step input of 15 volts and, unloaded, is measured to accelerate immediately at a rate of 15 rad/sec<sup>2</sup>. Assume a frictionless system and compute the armature inertia.