
Assignment 01

Yes, these are being graded. Strict due dates
Submit a fully explained assignment as if this were a “regular” course.
Show all work.

Undergraduates (Chris, Guillermo, Jill): Due Thursday 2/6/2003)

Each of you will be analyzing a different motor using whatever manufacturer’s data you can find. The questions that you each need to answer are below.

Chris: Jameco Electronics (<http://www.Jameco.com>) sells a variety of DC Gear Head motors (built in gearing). Find the motor data for their part number **164785** (product number GH12-1640Y). Their website has a full data sheet for this motor.

Jill: Jameco Electronics (<http://www.Jameco.com>) sells a variety of DC Gear Head motors (built in gearing). Find the motor data for their part number **162190** (product number GH12-1324Y225). Their website has a full data sheet for this motor.

Guillermo: RC car motor (Trinity P2K Pro). Data provided here is for a voltage of 5 V.

Max rpm:	18,360
Max power:	58W @ 8,800 rpm
Max efficiency:	45.4% @ 11,400 rpm
Stall Torque:	98.7 N·mm

Questions for Undergraduates:

1. Produce a multi-line plot of the *Motor Efficiency* (η) vs. *Torque* ($N\cdot m$) at the following voltages: 4.5, 5.0, 6.6, 7.2, 9.0, 15.0, 24.0 (Volts).
2. Produce a multi-line plot of the *Necessary Wheel Speed* (rpm) vs. *Wheel Diameter* ($inches$) in order to maintain the following vehicle velocities: 1, 3, 5, 7, 10, 15, 20 (mph).
3. Assume a 6.6 Volt (average) operating voltage on a 3500 mA·H battery pack. What is the maximum efficiency for this voltage? For the conditions of this maximum efficiency, calculate:
 - a. Motor shaft speed (rpm)
 - b. Current Draw (A)
 - c. Torque ($N\cdot m$)
 - d. What would be the necessary gear ratio (G) to match this ideal ($\max \eta$) motor speed with the wheel shaft speed needed to go 10 mph?
 - e. What would be the maximum range (miles) of a vehicle supplied with one of the given battery packs if it were operating at η_{max} and 6.6V?
4. Repeat question 3 using a voltage of 9.0 V instead of 6.6 V. Comment on any performance differences between the two operating voltages?

Graduates (Art): Due next week

1. Prepare a ~20-minute PowerPoint presentation on how to solder to be given next week. We will have lots of soldering to do and will need to distribute the work.
2. Prepare a brief survey (a page or two) of the available options for a 5 V regulated power supply for the RV electronics. Please document your sources so that it can serve as a good reference for future use. Summarize with your recommended products to be purchased. Keep in mind that our principle driver on that is efficiency. Cost is secondary, provided it isn't ridiculous.