

MEE 210 ELECTRIC MACHINES – Laboratory 1

Group # :	Name-Surname: Student ID #:	Point:
-----------	--------------------------------	--------

LABORATORY CONTENT: Driving a DC motor using relay and transistor

EQUIPMENT REQUIRED: (Students should bring all)

Qty Description

- 1 DC motor (better to be less than 0.5 A)
- 1 Multimeter
- 1 5 V Relay
- 1 Breadboard
- 1 2N2222 transistor (depends on the motor rated current, if your motor have higher than 0.8 A, pick another transistor with a higher one)
- 1 1N4001 diode
- 1 1k ohm resistor
- 1 Push button
- Wiring equipments (jumper cables, crocodiles, etc.)

PRELIMINARY QUESTIONS:

- 1) Read Exercise steps and find the expected values needed for the laboratory exercise.

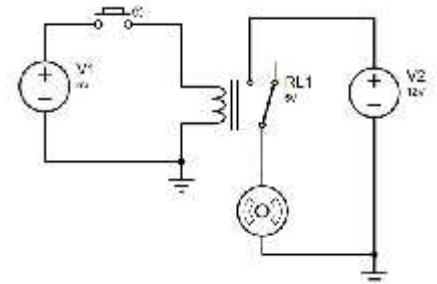
INTRODUCTION:

DC motors have one of the easiest methodology for driving. Simply, for a permanent magnet brushed DC motor, applying voltage between terminals is enough for transducing the electric power to mechanical power. The motors may derive with their working voltages and currents that the information is supplied by the manufacturer. If these values are exceeded, the motor may rotate faster, but overheating may occur and the lifespan of the motor may decrease.

EXERCISE STEPS:

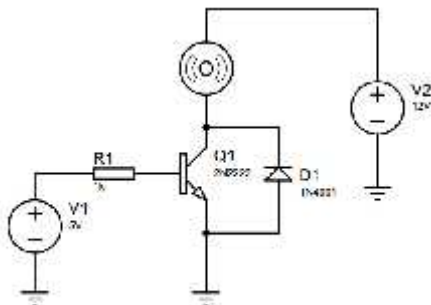
- 1) Test your motor if the motor is working properly or not. To do this, between the motor terminals, using the voltage supply, directly apply a voltage with equal or less than the voltage value typed on the motor. Be careful that the motor may slip from your hand or the desk when the rotor starts rotating.

- 2) Use a relay as a trigger for ON/OFF control of the motor. Use the figure on the right. V1 voltage depends on the relay value, and V2 voltage depends on the motor value, so adjust them regarding to them. Change V2 value and observe the change.



- 3) Use a transistor for driving the motor.

Apply the circuit on the left. From datasheet of the transistor, find the value $V_{BE,sat}$ where the saturation region starts and active region ends. Fill Table 1 and Table 2 considering this property.



POSTLIMINARY QUESTIONS:

- 1) Considering Exercise Step 2, does increment of V_1 voltage influence the circuit? Explain. Explain the difference between a relay and a contactor.
- 2) Fill Table 1 as in Exercise Step 3.

Table 1. Transistor based driving.

$V_{BE,sat}$	h_{fe}

Table 2. Transistor based driving.

V_1	10	9	8	7	6	5	4	3	2	1
V_{BE}										
i_{motor}										

- 3) As in Exercise Step 3, explicitly explain the purpose of using free wheeling diode.
- 4) What is “rated” or “nominal” term mean for electric machines? For which features of the electrical machines is that term used?
- 5) What are the other driving methods for driving DC motors? Explain each one with one sentence.
- 6) What are the methods used for speed control of DC motors? Explain each one with one sentence.

!!!!!!EXPERIMENT FOR NEXT WEEK:

Set up a circuit that realize on/off and direction controls of a DC motor by using relays. The mentioned controls will be realized via 2 bit digital input whose first bit will control the on/off modes of a DC motor while the second bit will determine the direction of DC motor.