EEM441 / Semester I (2025/2026) Due Date: _____

DC Motor / PID Control

1 Introduction

This manual outlines the setup and measurement steps for DC motor speed control. We will compare open- and closed-loop responses and tune PID gains.

2 Methodology

2.1 Open-Loop Test

Measure supply rails, connect the motor, and record steady-state speed.

2.2 Closed-Loop Test

Tune K_p, K_i, and K_d to minimize error:

$$u(t) = K_p e(t) + K_i \int_0^t e(\tau)\,d\tau + K_d \frac{de(t)}{dt}.$$

Appendix

```
// Example PID loop
error = ref - speed;
u = Kp*error + Ki*I + Kd*(error - error_prev);
apply(u);
```


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Objectives

1. To study open-loop speed control of a DC motor.
2. To study closed-loop control using:
   A) P Controller
   B) PD Controller
   C) PI Controller
   D) PID Controller

Apparatus

1. Controller kit
2. Oscilloscope
3. BNC cables
4. Multimeter