MEC4126F: Integrated Embedded Systems

Prac 7
08 May 2025

Total marks: 51

Instructions to students

1. This template file contains space for the answers to the written questions of Prac 7.
2. Ensure that you copy-paste your answers inside the space allocated for each question.
3. Provide your numerical answers to **TWO (2)** significant decimal points, unless stated otherwise.

PeopleSoft ID: 1879813

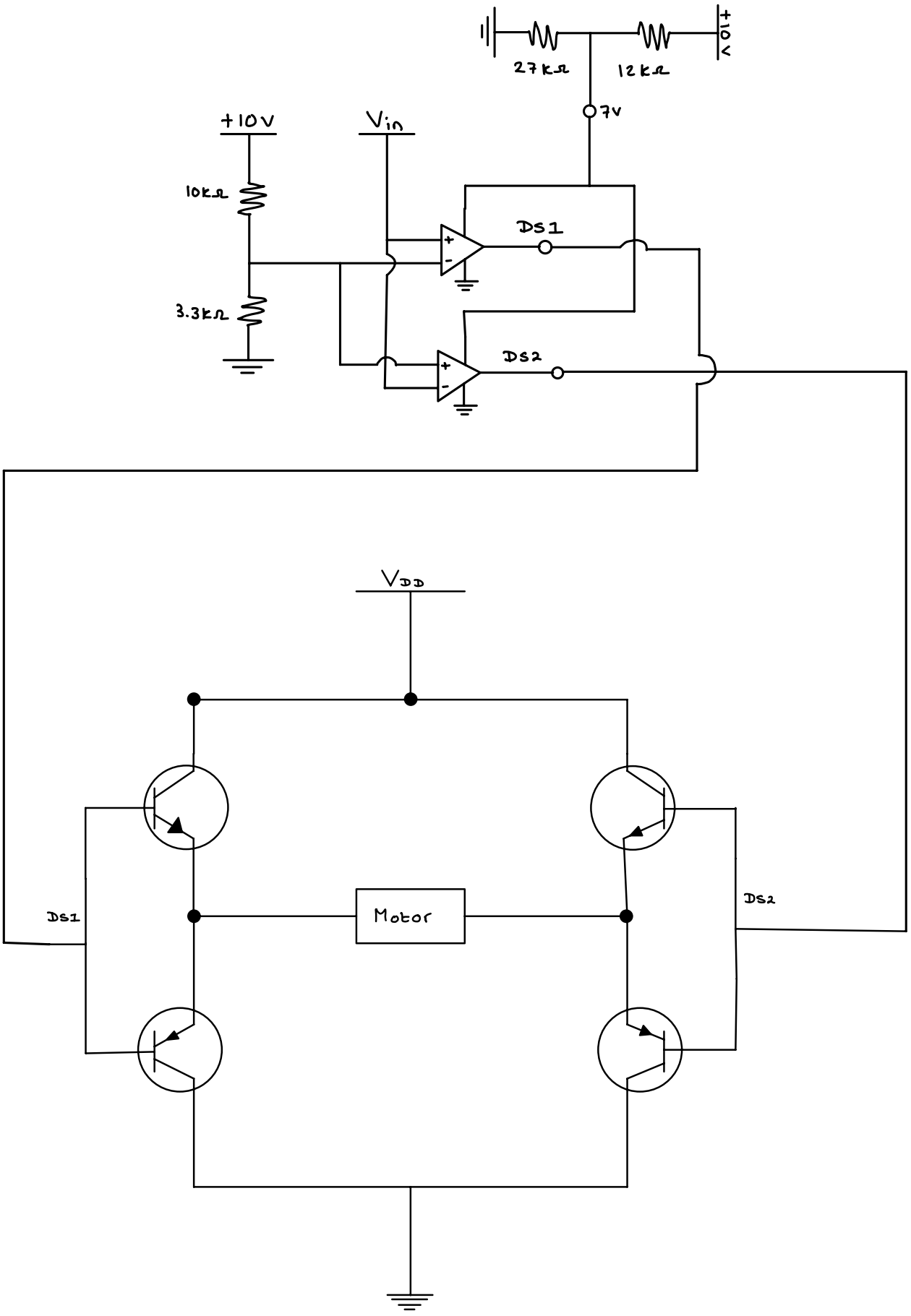
Plagiarism Declaration

By demonstrating and submitting this practical I agree that:

- I know that plagiarism is a serious form of academic dishonesty.
- I have read the document about avoiding plagiarism, am familiar with its contents and have avoided all forms of plagiarism mentioned there.
- Where I have used the words of others, I have indicated this by the use of quotation marks.
- I have referenced all quotations and other ideas borrowed from others.
- I have not and shall not allow others to plagiarise my work.
- I have not used an AI language model to generate the code or answers submitted here.

Name: Daniele Sguazzin Signature: 

Question 1 (6 marks)



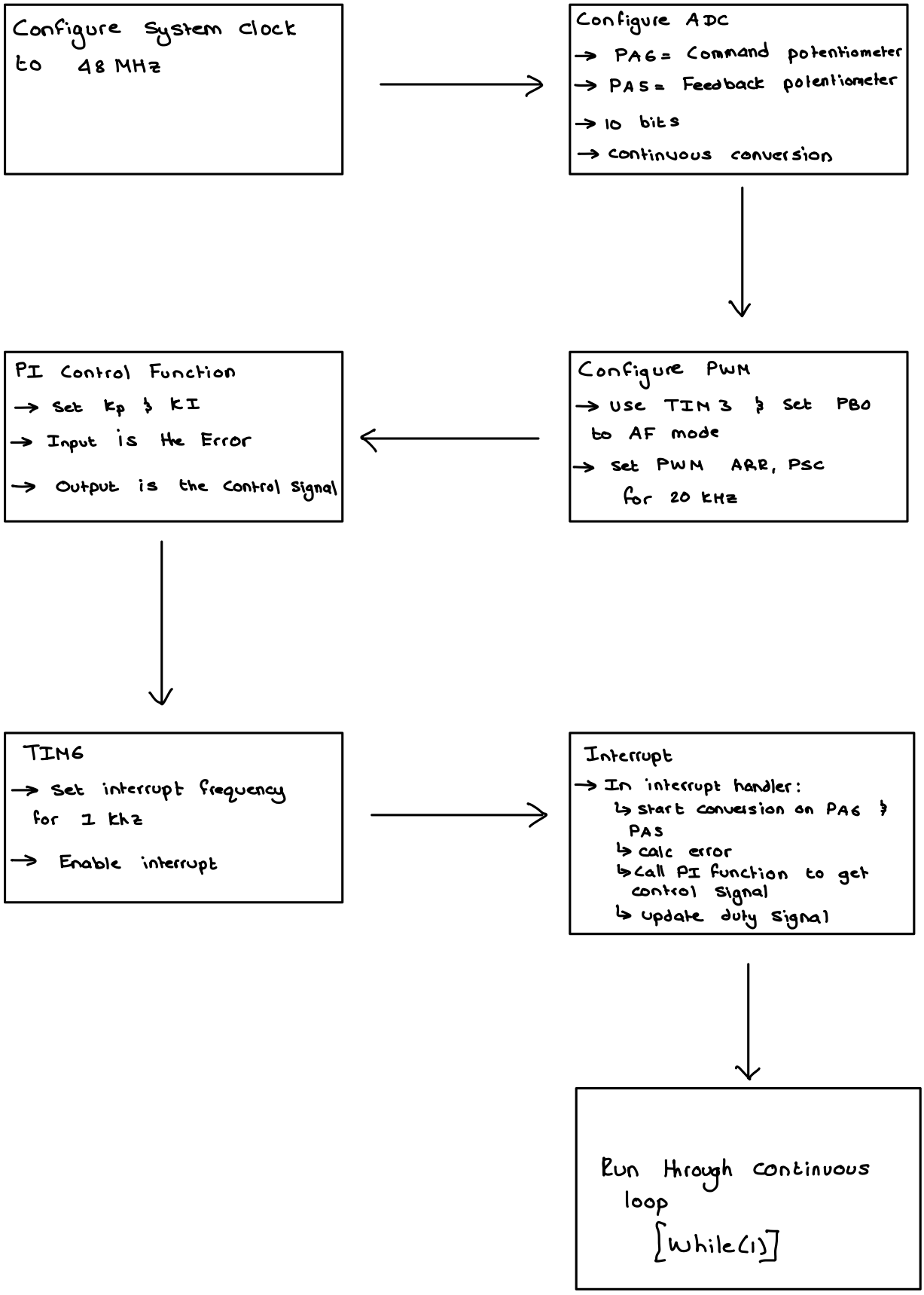
Question 2 (3 marks)

Vin	Comparator Output A (V)	Comparator Output B (V)
> Vref	8.4	0.7
< Vref	0.6	8.5

Question 3 (3 marks)

Comparator Output A (V)	Comparator Output B (V)	H-bridge direction
≈ 8.5	≈ 0.6	Forward
≈ 0.5	≈ 8.4	Reverse

Question 4 (14 marks)



Question 5 (6 marks)

Proportional gain
- ↳ Increase system response speed
- ↳ Too high: overshoot

Integral gain
- ↳ Eliminates steady-state error
- ↳ Too high: slow response

Sample Time
- ↳ Determines control loop frequency
- ↳ Too long: poor control
- ↳ Too short: unnecessary processor load

Question 6 (10 marks)

(a) Slew rate ≈ 0.5 V/μs

$7\text{V} \Rightarrow t = \frac{7}{0.5} = 14$ ms

$T_{PWM} > \frac{14 \text{ ms}}{0.01} = 1.4$ ms

$f_{PWM} < \frac{1}{1.4 \times 10^{-3}} \approx 714.286$ Hz

$\therefore$ max freq = 714 Hz

$$T = \frac{(PSC+1)(ARR+1)}{48 \times 10^6}$$

Let $PSC = 60$

$$\therefore 1.4 \times 10^{-3} = \frac{(60+1)(ARR+1)}{48 \times 10^6}$$

$\therefore ARR = 1100$