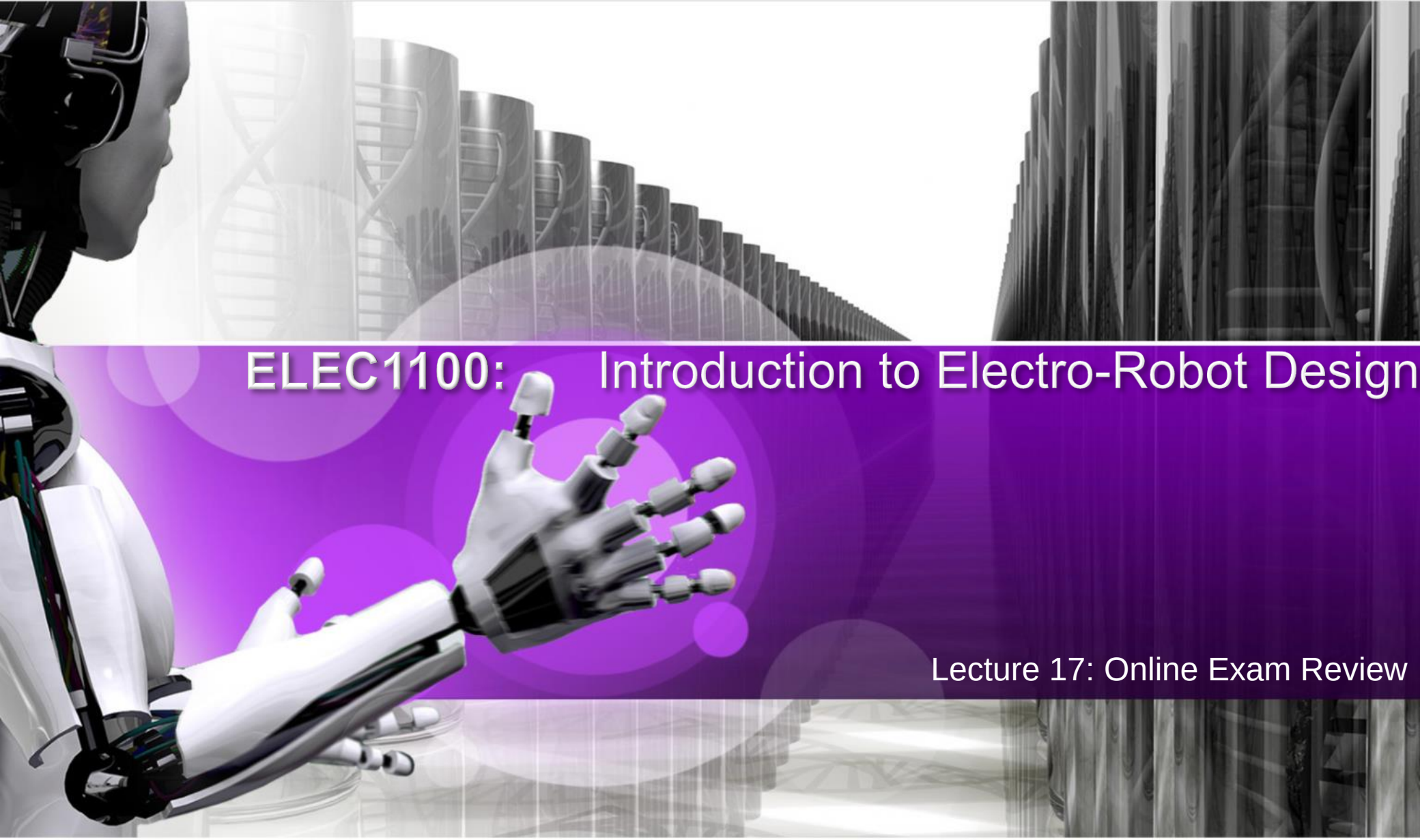


ELEC1100: Introduction to Electro-Robot Design

Lecture 17: Online Exam Review

SONG Shenghui and MURCH Ross, Dept. of ECE, HKUST

ONLINE EXAM

- **Online Exam (15%)**: May 02 (Sat), 10:00am-12:00noon

  Similar to examples in Lecture/Tutorial notes. Mainly tests on key concepts.

- You will need to take the exam on Canvas Page: **ELEC1100 Online Exam**

- Coverage: Lectures 02-12
- Supporting document on your Canvas Lecture (L1/L2/L3) page:
  - Online Exam Arrangement
  - Additional Exercises

POLICIES

- This is a **closed-book** and **closed-note** exam.
- Canvas exam page should be the **only window/tab** on your computer screen.
- Talking or discussion with others is NOT allowed in the exam.
- **No headphones allowed.**
- **No Calculators allowed.**
- **Scratch Paper (A4 size blank sheets) is allowed.** But your scratch paper will NOT be graded.

EXAM DEVICES

- Get the following electronic devices ready before the exam starts
  - **1 mobile phone**: to join Zoom Meeting and enable exam invigilating
  - **1 computer**: to log in Canvas Exam page and answer questions

Now, place your mobile phone camera to let us see your face/head and the canvas page on the screen. The exam invigilator and you will see this:

Keep your mobile speaker on for receiving instructions from your TA

EXAM SCHEDULE

- 10:00: **Zoom meeting starts**, you should join the meeting before 10:10am.
- 10:10-10:30 **Preparation: You will be sent to breakout rooms**, where your TA will do an attendance check and camera check with you. **Being uncooperative (camera off, or camera placement not as required) will be immediately removed from the Canvas exam page.
- 10:30-11:00 **Session 1**. Your TA will announce the **access code** (to open up Session 1 Questions) at 10:30am.
- 11:00-11:10 [Toilet Break]
- 11:10-12:00 **Session 2**. Your TA will announce the **access code** (to open up Session 2 Questions) at 11:10am.
- 12:00 [End of the Exam]

EXAM SESSIONS

- **10:30 - 11:00: Session 1** [10 questions, 50 points]
  - Multiple Choice Single Answer
  - Multiple Choice Multiple Answers
- 11:00 - 11:10: Toilet Break

- **11:10 - 12:00 Session 2** [2 questions, 50 points]
  - Long Questions: show your calculation steps
- 12:00: End of the Exam

NOTES

- It's your responsibility to try to secure a **reliable internet connection** and get your electronic devices (1 mobile phone + 1 computer) ready before the exam starts.
- During the exam we will monitor you through Zoom. Misconduct will result in a zero mark.
- Any attempt to exam questions without attending at ZOOM meeting or during camera-off period will result in a zero mark.

formulae will be given

Timer Equations for NE555	$Clock\ High\ Time = 0.7(R_A + R_B)C_1$ $Clock\ Low\ Time = 0.7R_BC_1$ $Period = 0.7(R_A + 2R_B)C_1$

EXAM REHEARSAL

- **Exam Rehearsal: Apr 25 (Sat), 10:00am-11:30am**
- Through Canvas Page: **ELEC1100 Online Exam**
  - The rehearsal is for you to test all the procedure, your hardware, your software and your internet connection.
  - Your answers to the rehearsal questions will not be graded.

REHEARSAL SCHEDULE

- 10:00: **Rehearsal Meeting starts**, join the meeting before 10:10am.
- 10:10-10:30 **Into breakout rooms**, where your TA will do an attendance check and camera check with you.
- 10:30-10:36 **Session 1**. Your TA will announce the **access code** at 10:30am.
  (1 multiple choice single answer + 1 multiple choice multiple answers)
- 10:36-10:40 Toilet Break
- 10:40-11:30 **Session 2.** Your TA will announce the **access code** at 10:40am
  (2 long questions)

Note: You may submit and leave the rehearsal early after session 2 starts at 10:40am. However, if we don't see you at **10:00-10:40am** during the normal procedure, we will assume that you will not take the online exam on May 02.

PAST PAPER: DIODE AND REGULATOR

❖ Diode and Regulator:

In the voltage regulator shown below, the Zener diode has a breakdown voltage of V_{bd} = -6.8V.

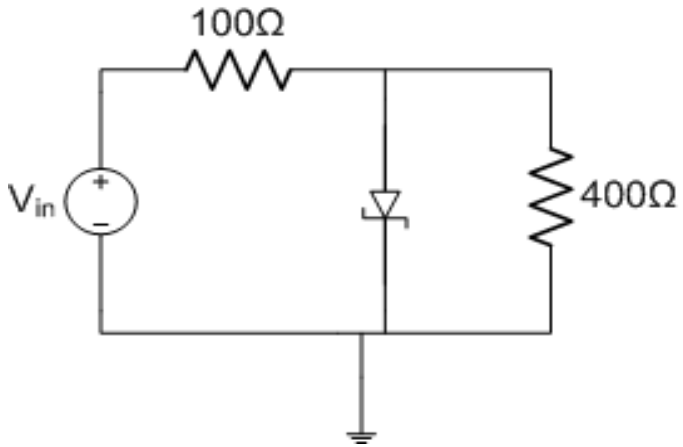
➢ What is the mistake in the circuit?

Zener diode is not reversely connected.

➢ Supposed the mistake is fixed, determine the minimum V_{in} that the Zener diode regulates the voltage.

$$V_{in} \times \frac{400}{100 + 400} = 6.8$$

$$V_{in} = 8.5V$$

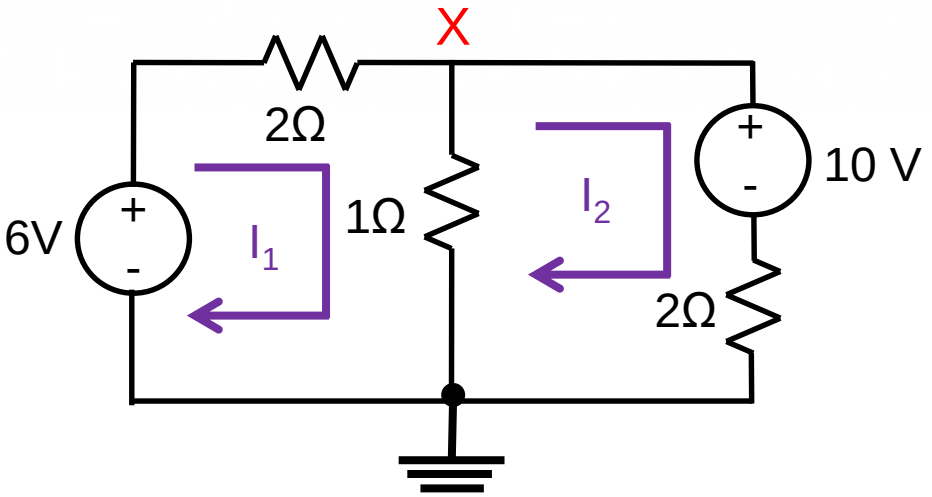


PAST PAPER: KCL & KVL

❖ KCL and KVL:

(a) Use KVL to write the voltage equation in each loop in terms of loop current $\mathbf{I_1}$ and $\mathbf{I_2}$.

(b) Based on the equations you got from part (a), solve the loop currents to determine the values of $\mathbf{I_1}$ and $\mathbf{I_2}$, and find the value of voltage **X**



Loop1: $6 - 2*I_1 - 1*(I_1 - I_2) = 0$

Loop2: $1*(I_1 - I_2) - 10 - 2*I_2 = 0$

$\Rightarrow$

$3I_1 - I_2 = 6$

$I_1 - 3I_2 = 10$

$\Rightarrow$

$I_1 = 1A$

$I_2 = -3A$

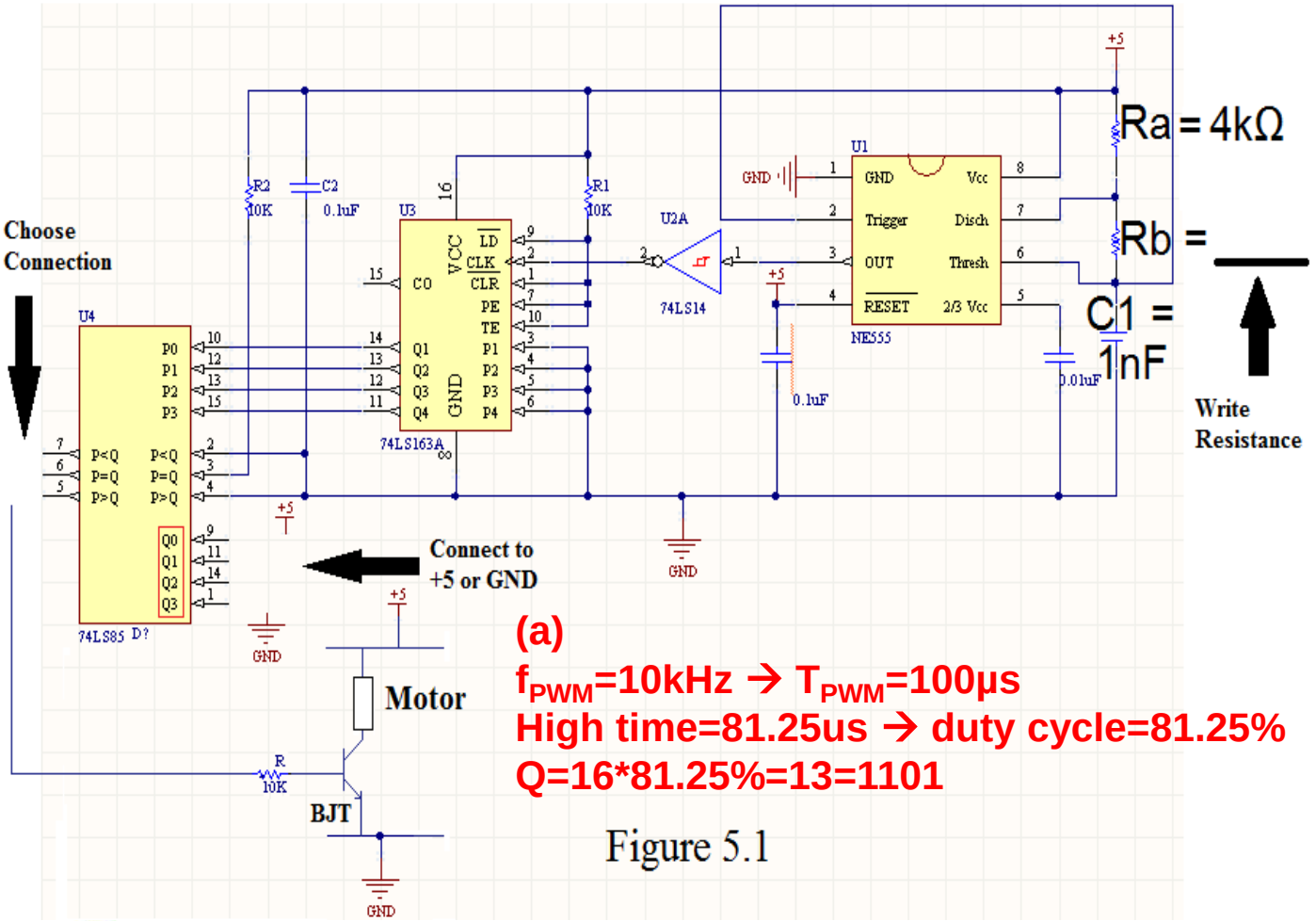
$$X = 1*(I_1 - I_2) = 4V$$

PAST PAPER: PWM CONTROL [1]

❖ PWM:

To design a PWM signal of frequency 10kHz and high time 81.25μs to drive a DC motor:

- (a) Determine Q3-Q0.
- (b) Calculate R_b using timer equations.
- (c) Complete the schematic.



(a)

f_{PWM}=10kHz → T_{PWM}=100μs

High time=81.25us → duty cycle=81.25%

Q=16*81.25%=13=1101

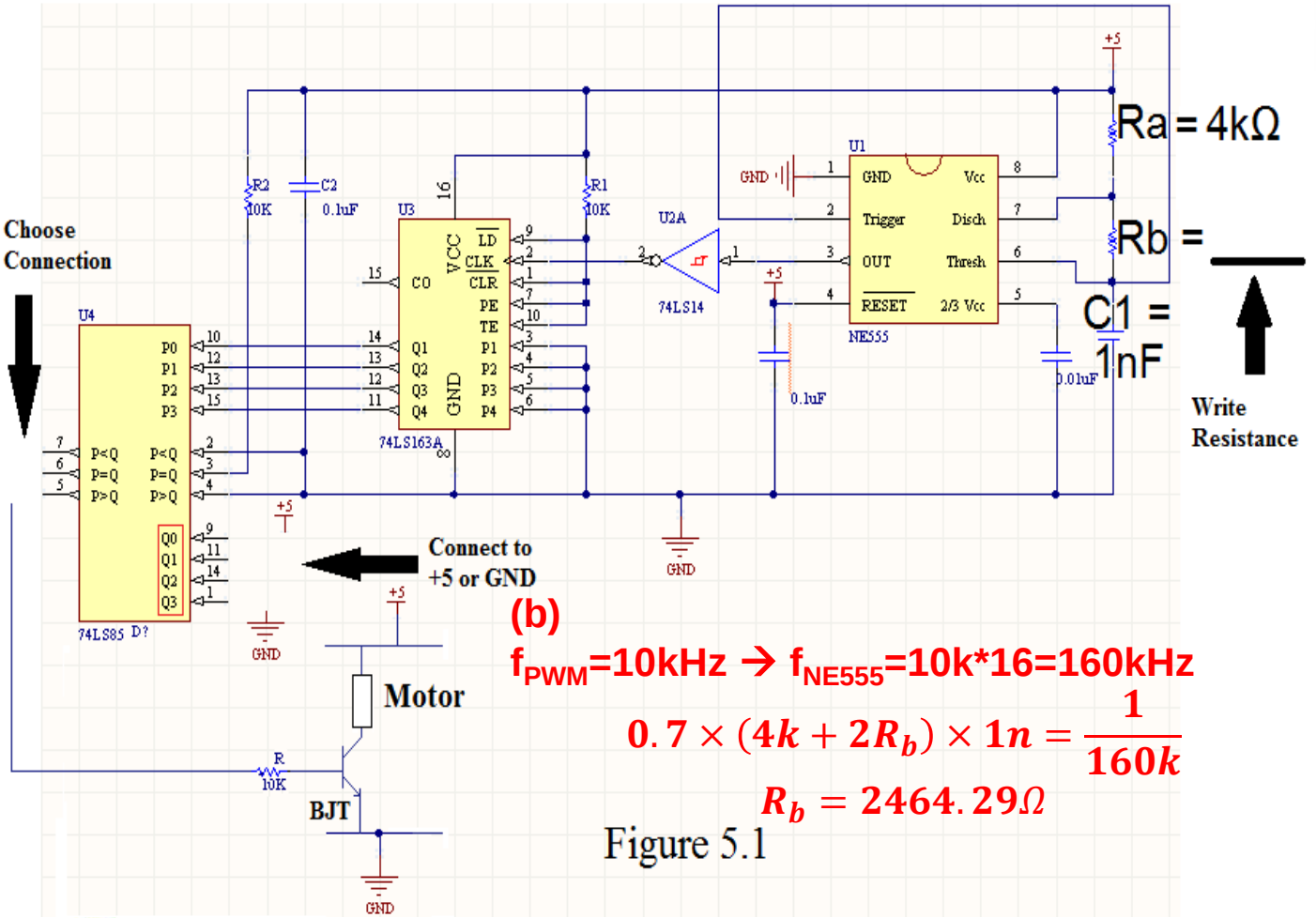
Figure 5.1

PAST PAPER: PWM CONTROL [2]

❖ PWM:

To design a PWM signal of frequency 10kHz and high time 81.25μs to drive a DC motor:

- (a) Determine Q3-Q0.
- (b) Calculate R_b using timer equations.
- (c) Complete the schematic.



(b)

f_{PWM}=10kHz → f_{NE555}=10k*16=160kHz

$$0.7 \times (4k + 2R_b) \times 1n = \frac{1}{160k}$$

$$R_b = 2464.29\Omega$$

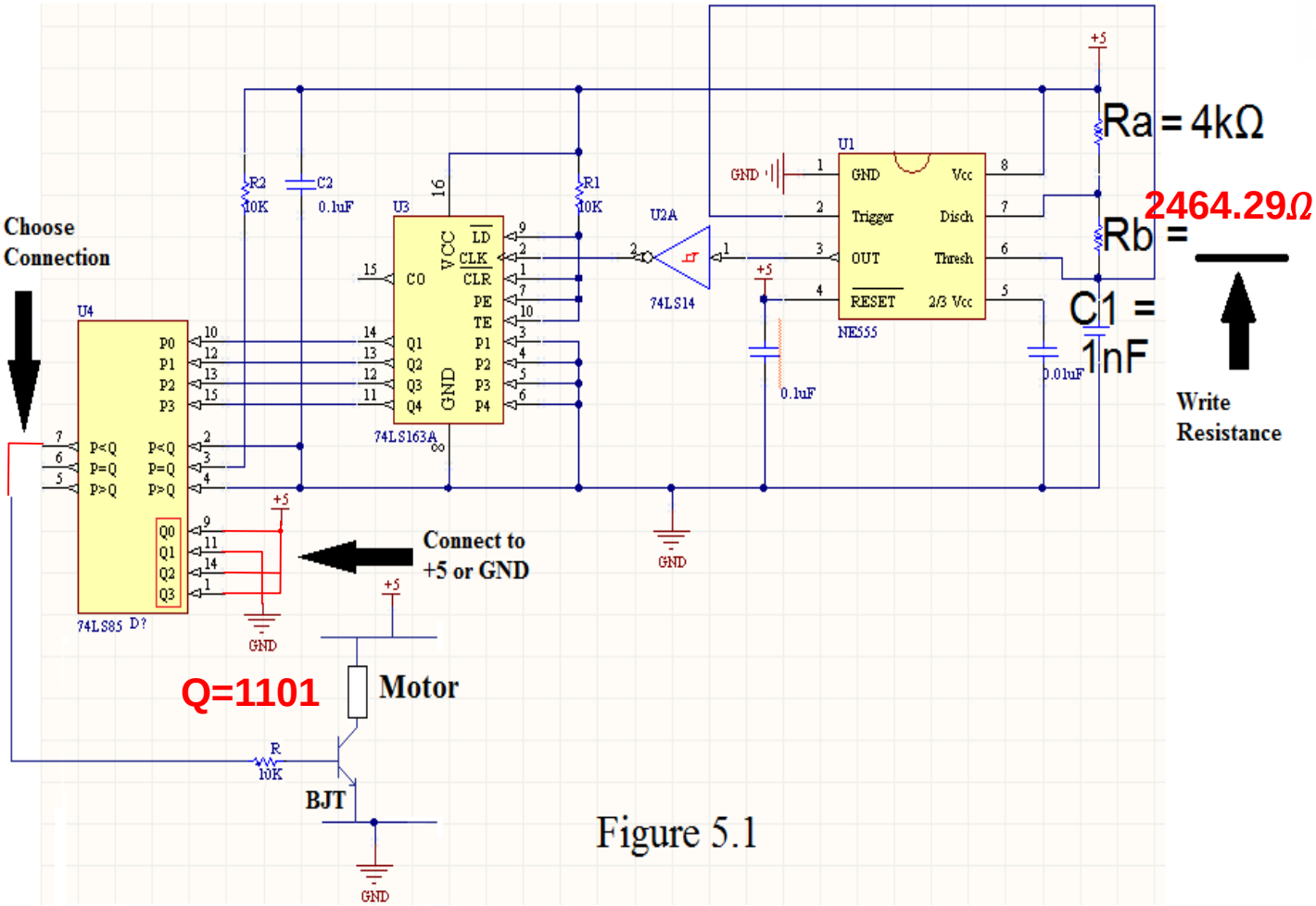
Figure 5.1

PAST PAPER: PWM CONTROL [3]

❖ PWM:

To design a PWM signal of frequency 10kHz and high time 81.25μs to drive a DC motor:

- (a) Determine Q3-Q0.
- (b) Calculate R_b using timer equations.
- (c) Complete the schematic.



PAST PAPER: LOGIC AND K-MAP [1]

❖ Logic and K-map:

We want to design a device to check whether an integer (from 0 to 9) is a multiple of 2 or 3. For example, the device returns true for integers 0, 2 and 3 but false for integers 1, 5 and 7. The decimal integer is input to the device as a 4-bit binary number (ABCD).

- Write down all the integers from 0 to 9 which are multiples of 2 or 3.

  0, 2, 3, 4, 6, 8, 9

- Finish the truth table for outputs. (Remarks: "don't care" conditions are allowed.)
- Use K-map to find out the *simplest* output expression in terms of the binary input ABCD.

A	B	C	D	Output
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

PAST PAPER: LOGIC AND K-MAP [2]

❖ Logic and K-map:

We want to design a device to check whether an integer (from 0 to 9) is a multiple of 2 or 3. For example, the device returns true for integers 0, 2 and 3 but false for integers 1, 5 and 7. The decimal integer is input to the device as a 4-bit binary number (ABCD).

- Write down all the integers from 0 to 9 which are multiples of 2 or 3.

  0, 2, 3, 4, 6, 8, 9

- Finish the truth table for outputs. (Remarks: "don't care" conditions are allowed.)

- Use K-map to find out the *simplest* output expression in terms of the binary input ABCD.

A	B	C	D	Output
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	X
1	0	1	1	X
1	1	0	0	X
1	1	0	1	X
1	1	1	0	X
1	1	1	1	X

PAST PAPER: LOGIC AND K-MAP [3]

❖ Logic and K-map:

We want to design a device to check whether an integer (from 0 to 9) is a multiple of 2 or 3. For example, the device returns true for integers 0, 2 and 3 but false for integers 1, 5 and 7. The decimal integer is input to the device as a 4-bit binary number (ABCD).

- Write down all the integers from 0 to 9 which are multiples of 2 or 3.

  0, 2, 3, 4, 6, 8, 9

- Finish the truth table for outputs. (Remarks: "don't care" conditions are allowed.)

- Use K-map to find out the *simplest* output expression in terms of the binary input ABCD.

Output = D'+A+B'C

		AB			
		00	01	11	10
CD	00	1	1	X	1
	01	0	0	X	1
	11	1	0	X	X
	10	1	1	X	X

A	B	C	D	Output
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	X
1	0	1	1	X
1	1	0	0	X
1	1	0	1	X
1	1	1	0	X
1	1	1	1	X

QUESTIONS?