THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Department of Electronic and Computer Engineering
ELEC 1100

Laboratory 3: Pulse Generation (5%)

A) Objectives

- To generate pulses from a constant supply.

B) Equipment

- NE555 Timer, 74HC14 Schmitt-Trigger Inverter,

C) Experimental Procedures

Reminder: 1) Switch off the power supply when constructing or amending circuits.

2) Always optimize the arrangement of components on your breadboard to save space for future labs

Review: LM7805 Voltage Regulator (~10 mins)

Refer to Lab#02, connect the power supply to your breadboard and set the power supply to 12V. Measure the output of LM7805 to confirm it is about 5V.

****** TA Check: Show your TA that your regulator obtained 5V output from 12V.**

TA check: review breadboard, 5V on rows and columns

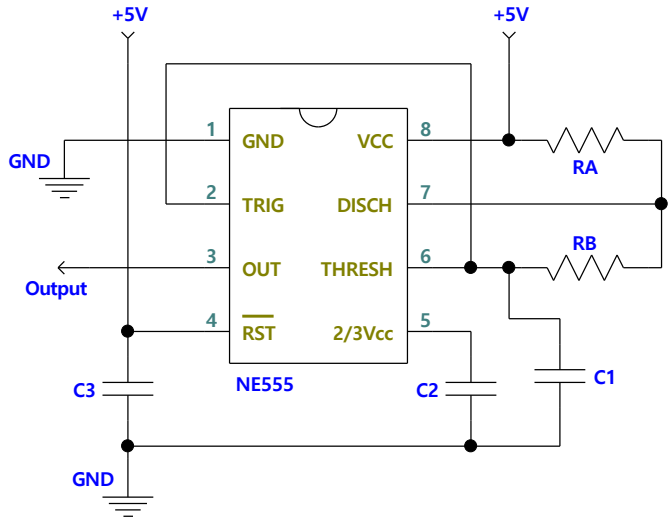
Experiment 1: Constructing a pulse generator with a NE555 Timer (~30 mins)

Step 1: Take a timer IC (NE555) and construct the circuit shown next page with the component values below.

$$R_A = 30k\Omega,\ R_B = 10k\Omega,\ C_1 = C_2 = C_3 = 0.1\mu F$$

Note that the 5V should be from the LM7805 regulator output (Check the Review part), i.e. 5V-row on your breadboard.

Put this timer circuit below the LM7805 regulator circuit on the breadboard, such that it occupies less space (but keep it tidy), saving space for future labs. (You may refer to Tutorial notes for the breadboard arrangement).



The number on the capacitor is read as:

- Digits 1, 2: Significant bits
- Digit 3: Multiplier, i.e. 10^n
- Basic unit: pF ($p = 10^{-12}$)

E.g. "104" = 10×10^4 pF = 0.1µF

Step 2: Use DSO to observe the output at pin 3 of the NE555.

****** TA Check 1: Show the generated pulse at pin 3 to your TA**

Q1: With the formulae given below, what should be the theoretical (calculated) frequency and duty cycle of the pulse signal generated? (Show your calculation)

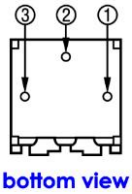
Clock High Time = 0.7 $(R_A + R_B)\, C_1$

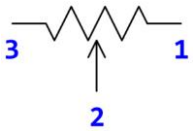
Clock Low Time = 0.7 $(R_B)\, C_1$

Period = 0.7 $(R_A + 2R_B)\, C_1$

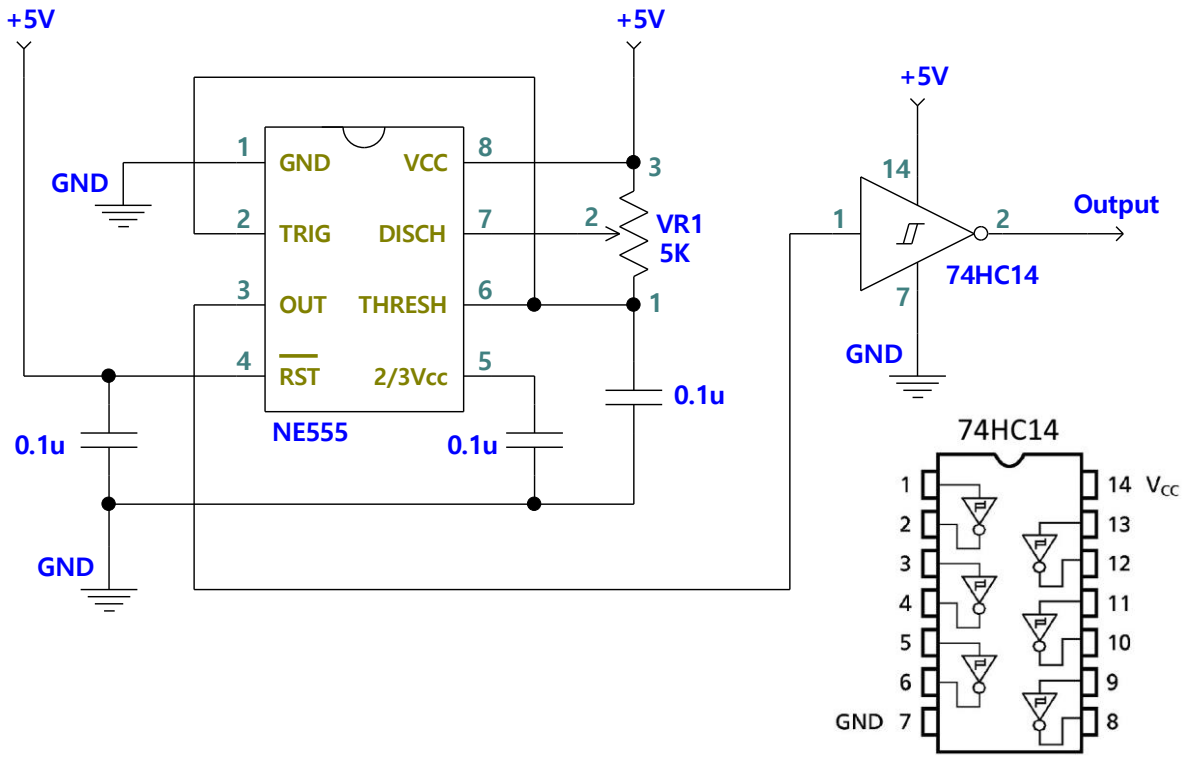
Experiment 2: Pulse generator for your project (~20 mins)

Step 1: Take a variable resistor. Note the pin assignments.





Step 2: Replace the resistors R_A and R_B in Experiment 1 with the variable resistor, as shown in the circuit diagram below.



Step 3: Connect a Schmitt-Trigger Inverter (74HC14) to the timer output (Pin 3 of NE555).

Step 4: Connect CH1 of the oscilloscope to the timer output (pin 3 of NE555), and CH2 to the Schmitt Trigger output (pin 2 of 74HC14). Press "Auto-Set" to display both waveforms, CH1 at the top and CH2 at the bottom. Reminder: Set the DSO probes to 1X if necessary.

Step 5: Use the screwdriver in your project box to adjust the variable resistor until a square waveform of frequency (2 + x/200) kHz is obtained.

Note: In this lab, let x be the number represented by the 5th and 6th digits of your student ID. For example, if your student ID is 12345678, then x = 56.

****** TA Check 2: Demo to your TA. Each student should demo once with his/her own student ID.**

Q2: What is the difference between the waveforms? (indicate the function 74HC14)

Remember to clean up your bench! A messy table will cost 3 points!