

Fundamentals of Engineering Design (FED) 101- LCA

Test 3

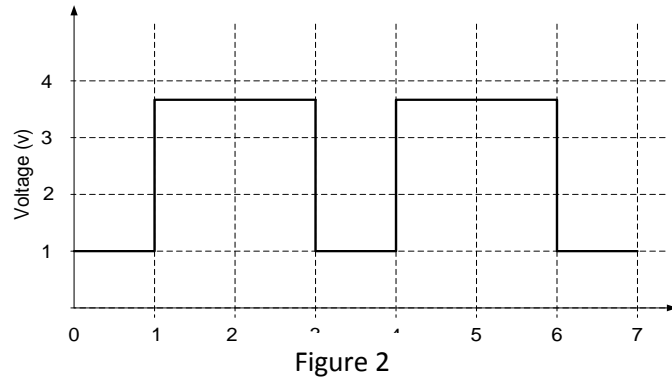
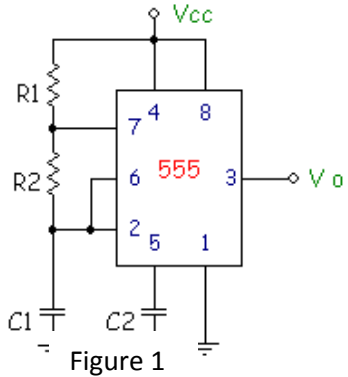
Student name:

Student ID number:

Please provide complete and clear answers.

1. Consider the 555 timer shown in Figure 1 with $C1=10\mu\text{F}$ and $C2=100\text{nF}$. The voltage at pin 3 is shown in Figure 2.

- What is the duty cycle of the pulses? (2 points)
- Determine the values of $R1$ and $R2$ from the information in Figure 2. (4 points)
- What could you do to increase the duty cycle of the pulses? Explain your answer. (4 points)



Solution:

a) $T_{ON} = 2s, T_{OFF} = 1s, T = 3s$

$$\text{duty cycle} = T_{ON}/T = .667, \text{duty cycle} = 66.7\%$$

b) $T_{OFF} = 0.693(R2)(C1)$

$$1 = 0.693(R2)(10 \times 10^{-6})$$

$$R2 = 144300 = 144.3K \text{ ohms}$$

$$T_{ON} = 0.693(R1 + R2)(C1)$$

$$2 = 0.693(R1 + 144.3K)(10 \times 10^{-6})$$

$$R1 + 144.3K = 288.6K \rightarrow R1 = 144.3K \text{ ohm}$$

c) Increase $R1$ or decrease $R2$

When $R1 \gg R2$, the duty cycle approaches 100%