EE204: Analog Circuits

Dept of Electrical Engineering, IITB

Autumn Semester 2023

Assignment 6 **Date: 29-10-2023**

Total Marks: 10

Submission Deadline: 11:59 p.m., 05-11-2023

Mode of Submission: Scan your assignment and upload on Moodle as a single pdf file.

Q1: Consider the 555 circuit of Figure 1. when the Threshold and the Trigger input terminals are joined together and connected to an input voltage V_{in} . Find the transfer characteristic V_{out} vs V_{in} with thresholds $V_{TL} = \frac{1}{3}\ V_{CC}$ and $V_{TH} = \frac{2}{3} V_{CC}$ and output levels of 0 and V_{CC}.

(2Marks)

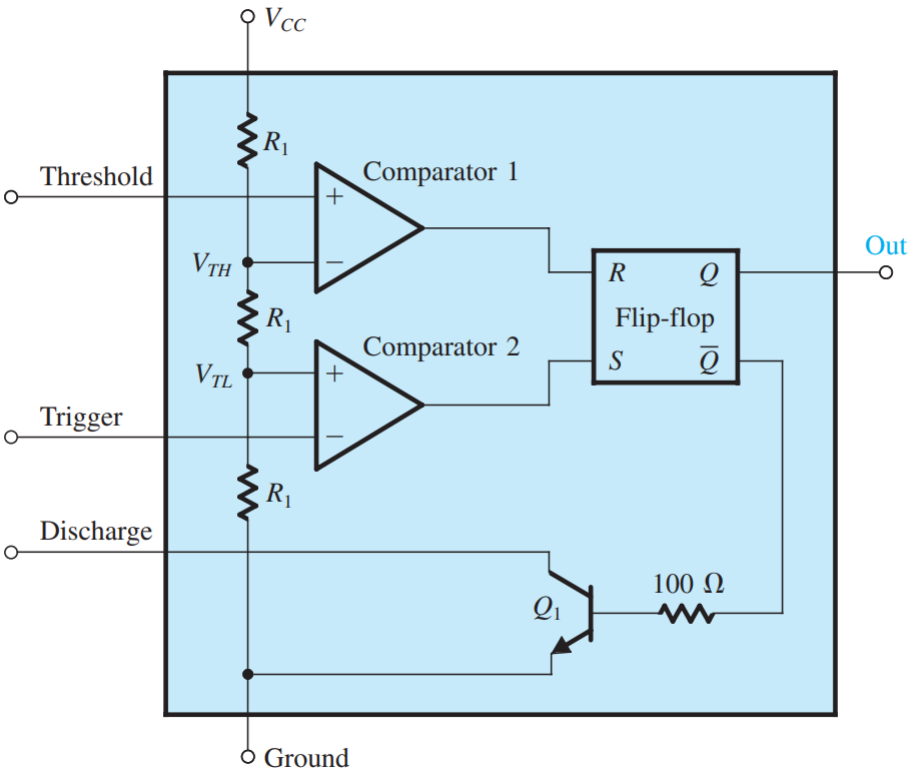

Figure-1

Q2.

(a) Using a 0.5-nF capacitor C in the circuit of Fig. 2(a), find the value of R that results in an output pulse of 10-μs duration. (1 Marks)

(b) If the 555-timer used in (a) is powered with V_{CC} = 12 V, and assuming that V_{TH} can be varied externally (i.e., it need not remain equal to $\frac{2}{3}V_{CC}$), find its required value so that the pulse width is increased to 20μs, with other conditions the same as in (a). (2 Marks)

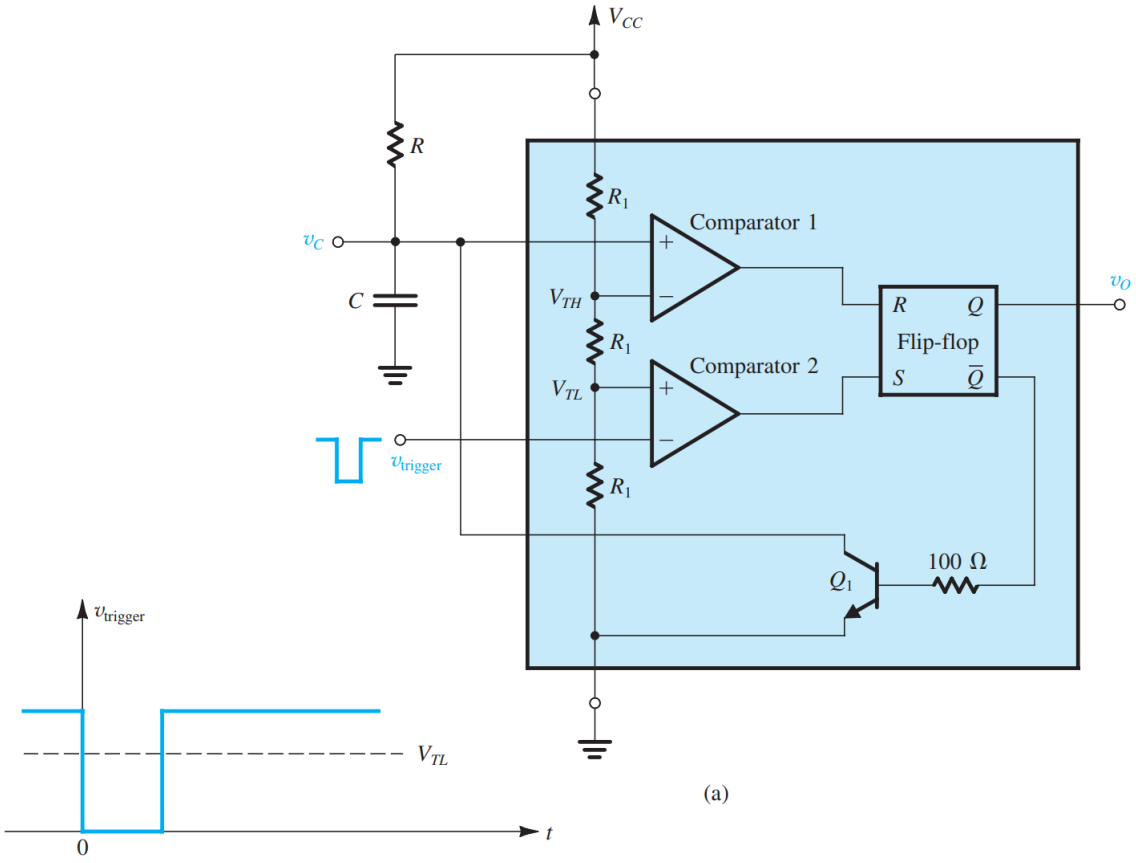

Figure.2

Q3.

a. A 4-bit flash ADC is shown in Figure 3.1(a). It is tested with a setup shown in Figure 3.2. The resulting reconstructed analog output is shown in Figure 3.1(b). Identify the problem and the most probable fault. (1 mark)

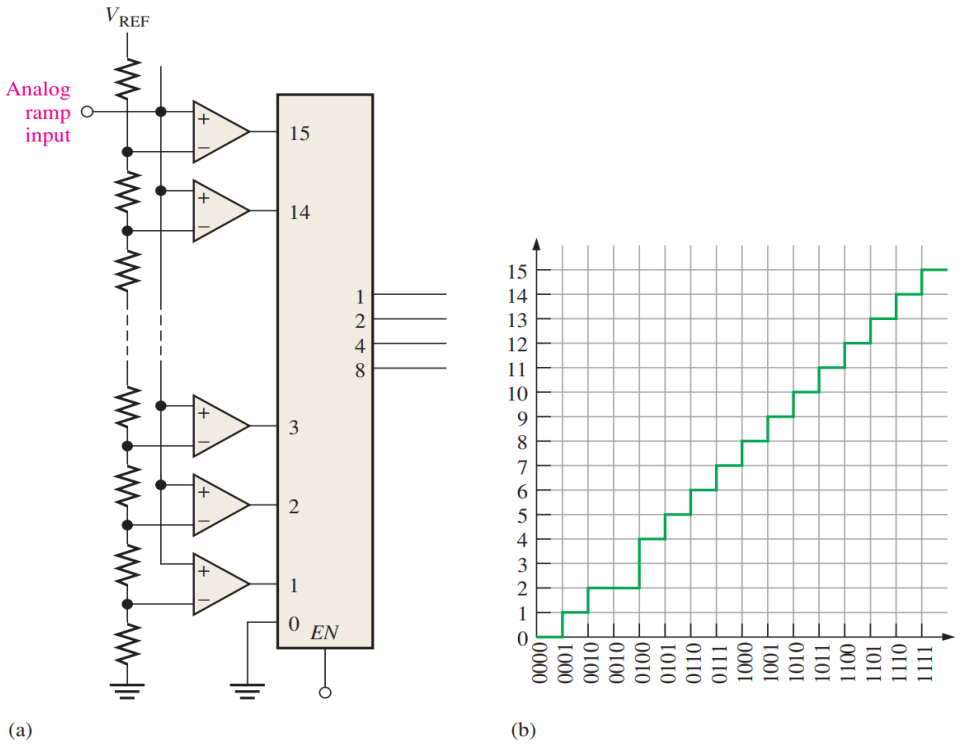

Figure – 3.1

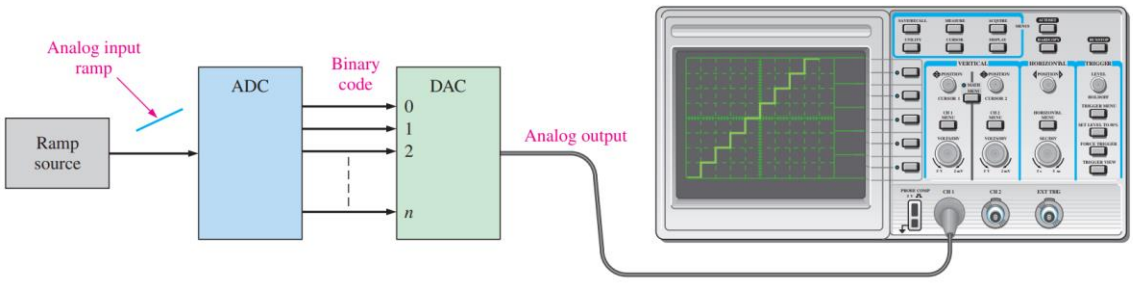

Figure – 3.2

b. A certain 8-bit ADC has a full-scale input of 2.55 V (i.e., V_A = 2.55 V produces a digital output of 11111111). It has a specified error of 0.1% F.S. Determine the maximum amount by which the output can differ from the analog input. (1 Marks)

Q4. The circuit shown in the Figure 4. works as a 2-bit analog to digital converter for $0 \leq V_{in} \leq 3$ V .

Find the expression for

a) MSB output Y_1 as a Boolean function of the inputs X_1, X_2, X_3 (1.5 Marks)

b) LSB output Y_2 as a Boolean function of the inputs X_1, X_2, X_3. (1.5 Marks)

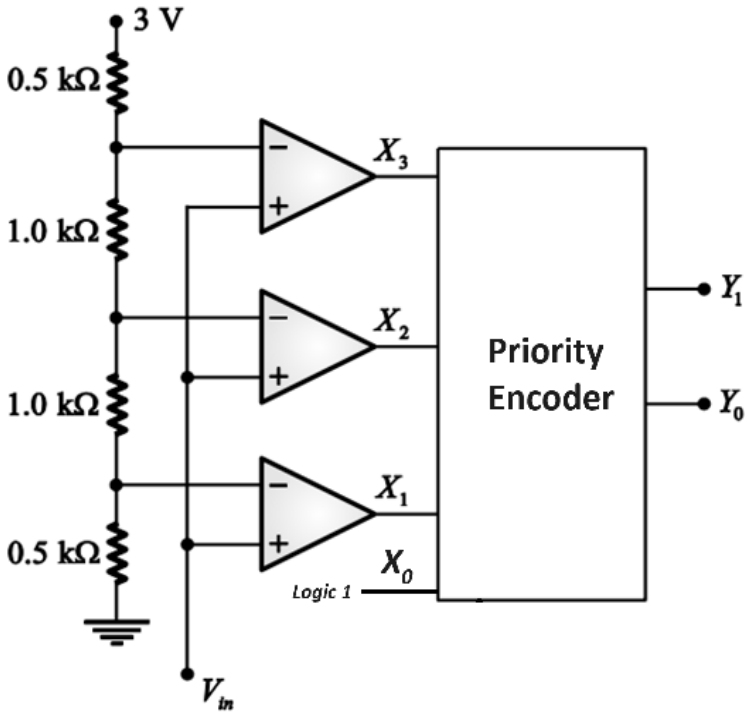

Figure 4