EE230 - Analog Lab Midsem
Spring Semester: Year 2021-22

February 17, 2022

Timing: 1:55 PM to 2:55 PM **Part-A** Max marks: 10

Instructions:

- **Read each question carefully. Also, strictly follow the upload instructions and timelines given in the questions.**
- **No additional time will be given.**
- **You can refer:** NGSPICE tutorial, model files uploaded on the course moodle / MS Teams channel and your written netlists of previous experiments / homeworks.

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1. **Question 1**

   (a) Refer to the circuit in the figure [1]. Sketch and annotate the VTC (V_{OUT} vs V_{IN}) of the inverting schmitt trigger. Mark the upper and lower threshold voltages on the VTC plot. (Assume, cut-in voltage of diodes, D1-D4 = $0.6V$ and Zener diodes, Z1-Z2 with forward voltage drop of $0.6V$ and zener breakdown voltage of $4.7V$). **[3 marks]**

   [Upload the hand-drawn sketch and calculations/ observations in a single pdf file with the name "Q1_a_roll_no.pdf" on moodle in 20 min, i.e., from 1:55 PM to 2:15 PM.]

   (b) Write an NGSPICE netlist for the circuit shown in figure [1]. Use the op-amp UA741 with dual supply of $\pm 15V$. Plot the VTC (V_{OUT} vs V_{IN}) by sweeping the input voltage, V_{IN} from $+10Vdc$ to $-10Vdc$ and then $-10Vdc$ to $+10Vdc$. Obtain the upper and lower threshold voltages and compare the values with that of the theoretical values observed in part-a. **[5 marks]**

   (c) Run a transient analysis for 5ms with a sinusoidal input of $12V_{pp}$ and a frequency of 1KHz. Plot the output (V_{OUT}) and the input (V_{IN}) waveform. **[2 marks]**
   [Upload the netlists, plots and observations (hand-written on a paper or typed in a document file) for Q.1 (b) and (c) in a single zip file with the file name "Q1_b_c_roll_no.zip" on moodle in 40 min, i.e., from 2:15 PM to 2:55 PM]

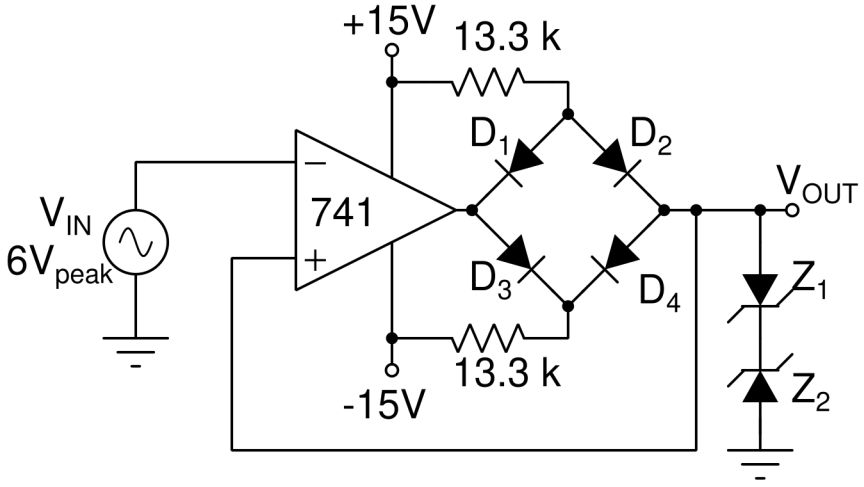

Figure 1: Inverting Schmitt Trigger