

Inter American University of Puerto Rico
Bayamón Campus
School of Engineering
Department of Electrical Engineering

ELEN 3311 – Electronics I

Midterm Exam

Wednesday, April 13

Name: _____

Enter all your work and your answers directly in the spaces provided on the printed pages. Full credit will only be given to answers that you neatly transfer to the spaces on the printed pages. Answers must be derived or explained, not just simply written down. The quiz is closed book, and calculators or notes are **not** allowed.

Problem	Value	Grade
1	40	
2	40	
3	20	
Total	100	

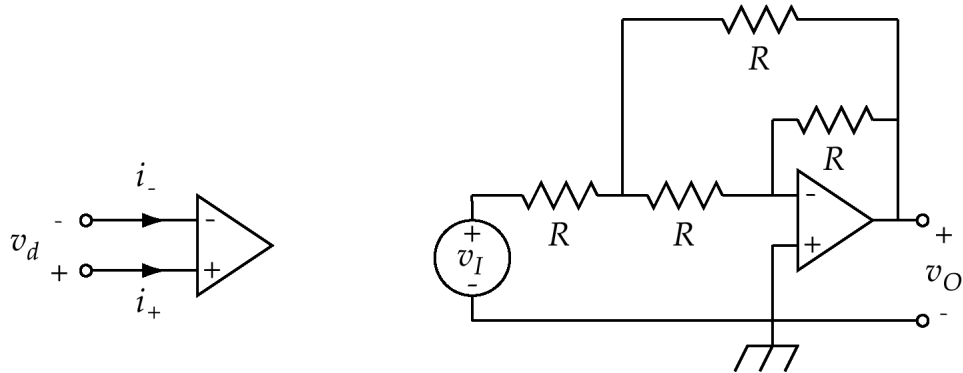
Problem 1: (40 points) The operational amplifier in the circuit shown below is ideal, and characterized by the equations:

$$i_+ = 0$$

$$i_- = 0$$

$$v_d = 0$$

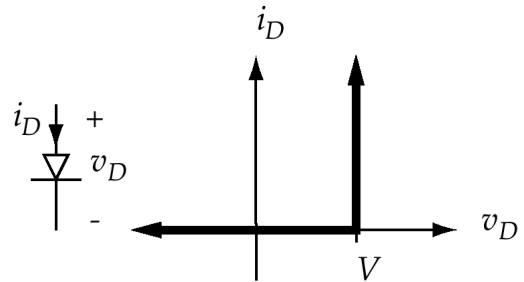
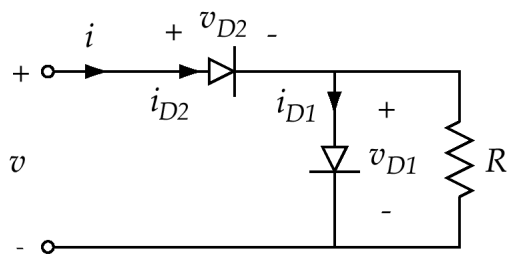
Find v_O in terms of v_I in the circuit shown below:



Problem 2: (40 points) The diodes in the circuit shown below have a piece-wise linear voltage-current characteristic shown below, where:

$$v_D = V, \text{ for } i_D \geq 0$$

$$i_D = 0, \text{ for } v_D \leq V$$



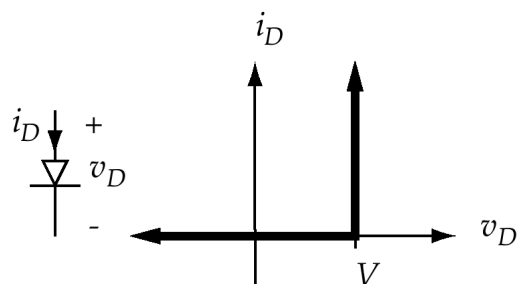
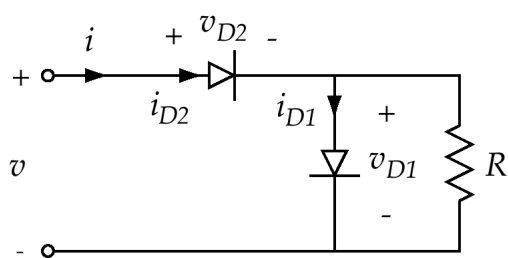
(A) Show that the state where $v_{D1} = V$ and $i_{D2} = 0$ is impossible.

- (B) Plot the voltage-current characteristic at the terminals shown in the circuit, where the diode equations are:

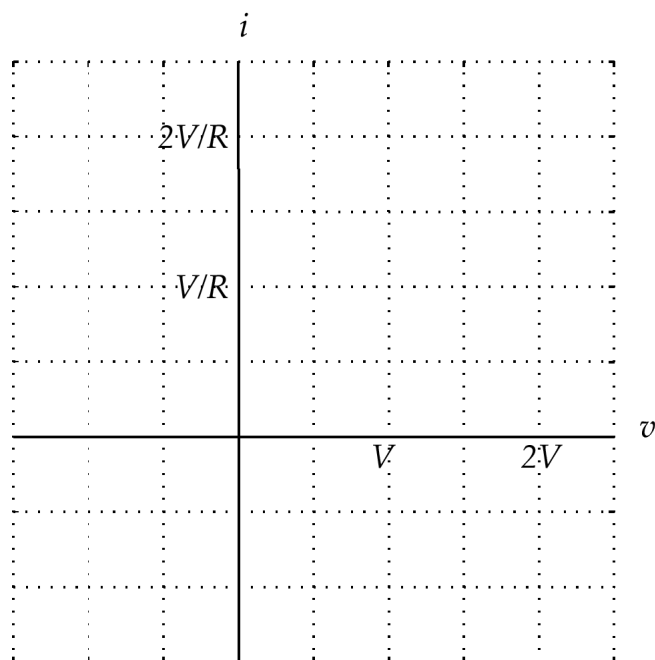
$$v_D = V, \text{ for } i_D \geq 0$$

$$i_D = 0, \text{ for } v_D \leq V$$

Use the axes provided and show all relevant voltages and currents.



Problem 2: (B), continued

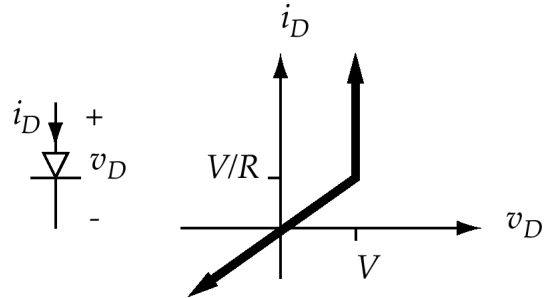
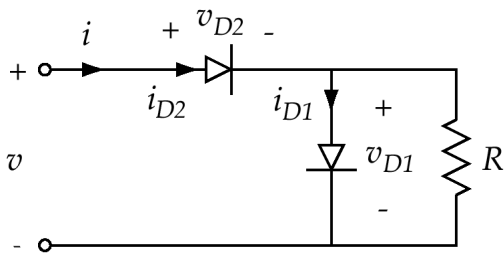


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Problem 3: (20 points + 20 bonus points) The new type of diodes in the circuit shown below have a piece-wise linear voltage-current characteristic shown below, where:

$$v_D = V, \text{ for } i_D \geq \frac{V}{R}$$

$$v_D = Ri_D, \text{ for } v_D \leq V \text{ or } i_D \leq \frac{V}{R}$$



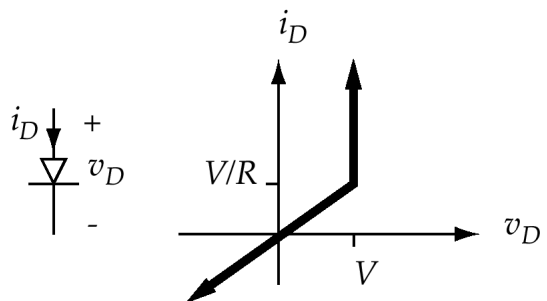
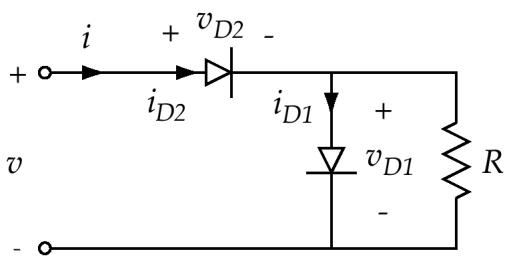
(A) Show that the state where $v_{D1} = V$ and $v_{D2} = Ri_{D2}$ is impossible.

(B) Plot the voltage-current characteristic at the terminals shown in the circuit, where the diode equations are:

$$v_D = V, \text{ for } i_D \geq \frac{V}{R}$$

$$v_D = Ri_D, \text{ for } v_D \leq V \text{ or } i_D \leq \frac{V}{R}$$

Use the axes provided and show all relevant voltages and currents.



Problem 3: (B), continued

