Examination Schedule

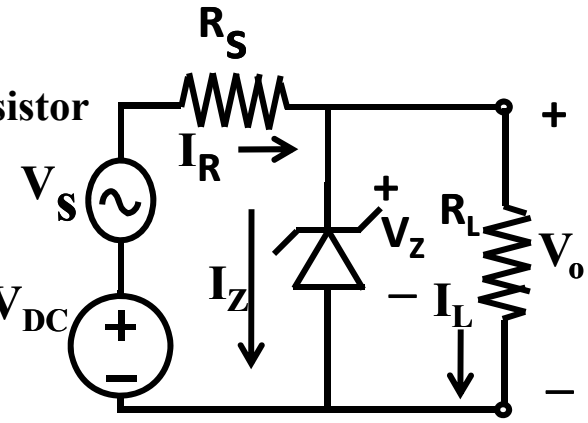
- Tutorial mini-Quiz (10 minutes) every Thursday in the first 10 minutes of the tutorial.
- 1st Major Quiz: Thursday, Sept. 05, 2019, 8:00-8.50 AM during tutorial hours in the respective tutorial classrooms.
- Mid-semester examination: Monday, Sept. 16, 2019, 8:00-10:00AM
- 2nd Major Quiz: Thursday, Oct. 03, 2019, 8:00-8.50 AM during tutorial hours in the respective tutorial classrooms.
- 3rd Major Quiz: Thursday, Oct. 31, 2019, 8:00-8.50 AM during tutorial hours in the respective tutorial classrooms.
- Laboratory Examination: Week of October 28 – November 08, 2019
- End-semester Examination: Monday, Nov. 18, 2019, 9:00-12:00AM

Tentative

ESc201, Lecture 15: Power Supply 1

Zener as a Shunt Regulator

R_S is the current limit resistor



DC source with some AC component, $V_{PS} = V_{DC} + V_S$

$$I_Z = \frac{V_{PS} - V_Z}{R_S} - I_L, \quad I_{Z_{max}} = \frac{V_{PS_{max}} - V_Z}{R_S} - I_L, \quad I_{Z_{min}} = \frac{V_{PS_{min}} - V_Z}{R_S} - I_L$$

$$R_S = \frac{V_{PS_{min}} - 0.1V_{PS_{max}} - 0.9V_Z}{0.9I_L}$$ with some safety margin

As one changes R_L, the current just shifts from the Zener to the Load

Let there be a margin of safety so that the diode renmains in the zener breakdown region for the max. and the min. current or assume $I_{Z_{max}}/I_{Z_{min}} \cong 10$

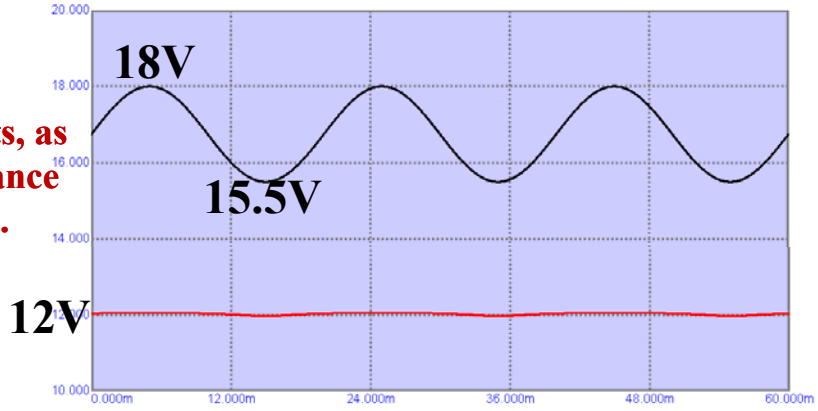
Example : V_{Z_B} = 12V, V_{PS} Varies between 15.5V and 18V. Restriction: I_{Zmax}/I_{zmin} should be 10, Given R_L = 108 Ω. Find R_S and max. power dissipated in diode.

Design equations: $$R_S = \frac{V_{PS_{min}} - 0.1V_{PS_{max}} - 0.9V_Z}{0.9I_L} = \frac{15.5 - 0.1\times 18 - 0.9\times 12}{0.9(1/9)} = \frac{15.5 - 1.8 - 10.8}{0.1} = \frac{2.9}{0.1} = 29\Omega$$

$$I_{Z_{max}} = \frac{V_{PS_{max}} - V_Z}{R_S} - I_L = \frac{18-12}{29} - \frac{1}{9} = \frac{6}{29} - \frac{1}{9} = 0.096 \text{ A}$$

$$I_L = \frac{V_L}{R_L} = \frac{12}{108} = \frac{1}{9}$$

Even then a small fluctuation exists, as the Zener does have a small resistance (Not considered in the calculation).



$$P_{Z_{max}} = V_Z I_{Z_{max}} = 12 \times 0.096 = 1.152 \text{ W}$$

$$P_{Z_{max}} = \left(V_Z + I_{Z_{max}} r_Z\right) \times I_{Z_{max}} = V_Z I_{Z_{max}} + I_{Z_{max}}^2 r_Z \text{ W}$$