

Physics 517/617 Homework 2

Problems for AC circuits

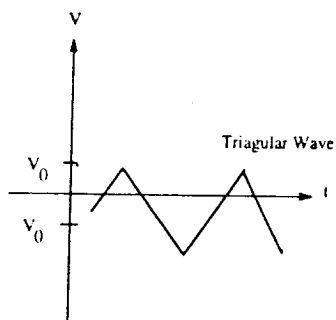
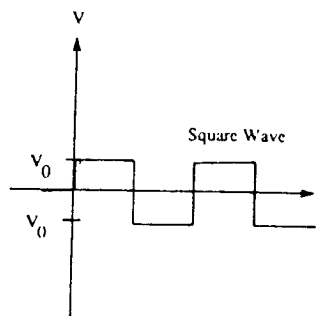
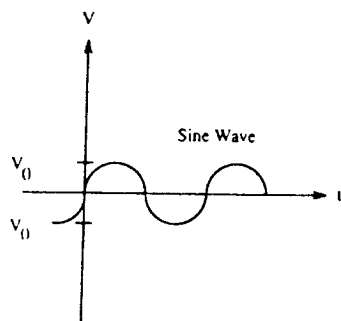
Introductory Electronics for Scientists and Engineers, Simpson

Chapter 2 problems: 2-10,2-11,2-13,2-19

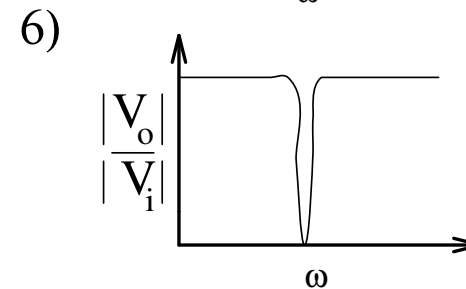
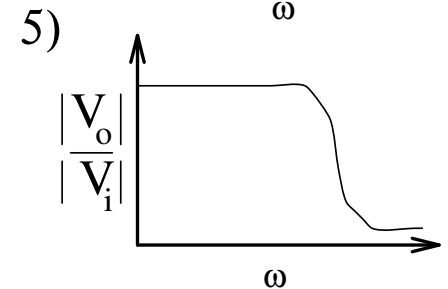
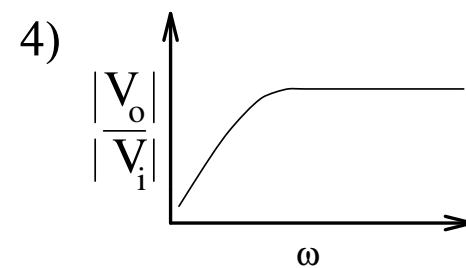
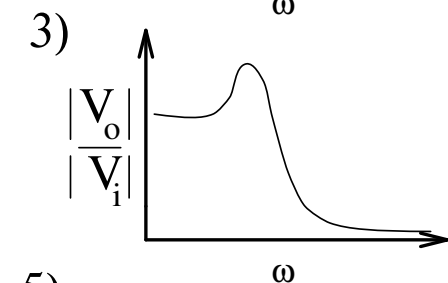
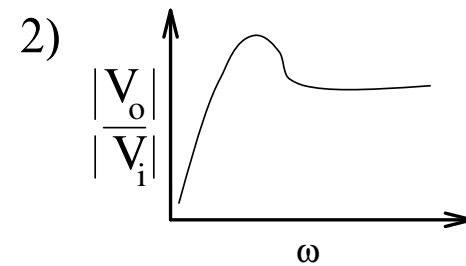
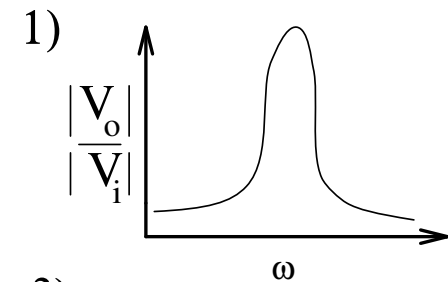
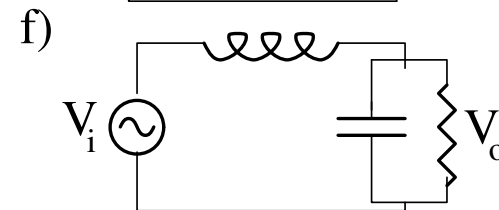
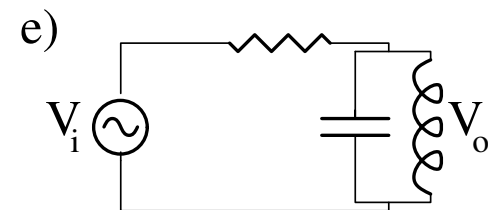
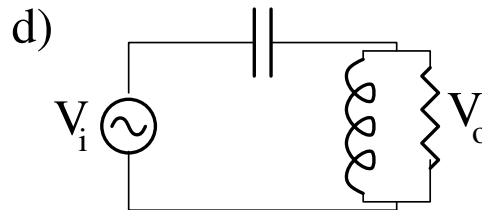
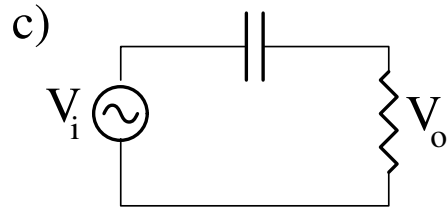
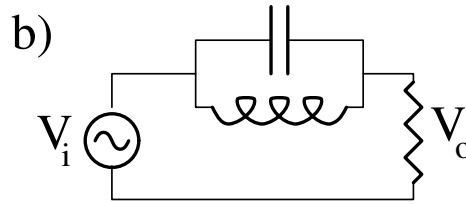
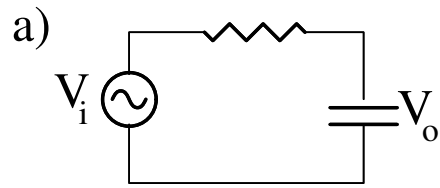
- 1) In the analysis of circuits it is useful to talk about the R.M.S. (root mean square) voltage (V_{RMS}). Define V_{RMS} as :

$$V_{\text{RMS}}^2 = \frac{1}{T} \int_0^T V(t)^2 dt$$

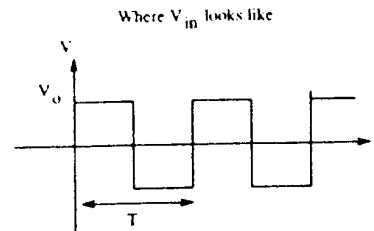
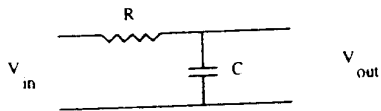
Calculate V_{RMS} for the following voltages, $V(t)$.



2) For each of the following circuits identify the corresponding magnitude Bode plot. For most cases the Bode plot can be identified by considering the limits $\omega \rightarrow 0$ and $\omega \rightarrow \infty$.

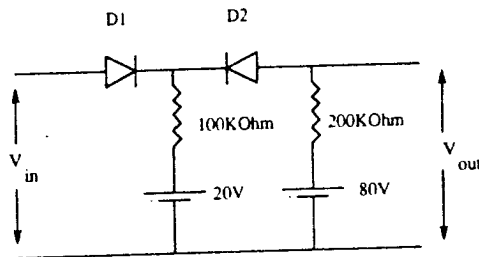


- 3) Plot the output for the following circuit for $RC = T/2$ (If you are lazy use BSPICE).

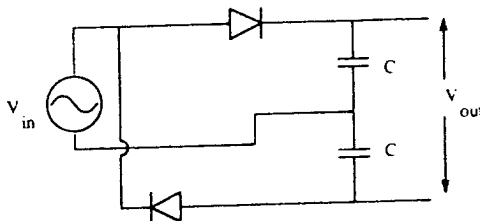


Problems for Diode circuits

- 4) (Millman 10-12) The input v_i to the two-level clipper shown below varies linearly as a function of time from 0 to 100 volts. Sketch the output voltage v_o to the same time scale as the input voltage assuming ideal diodes.

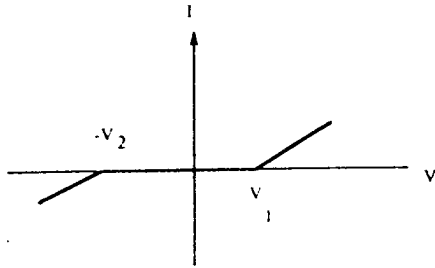


- 5) What does the following circuit do and why (assume ideal diodes) ?

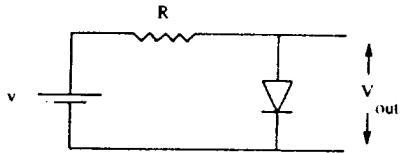


6) (Millman 10-20)(assume ideal diodes)

- a) Construct a circuit that exhibits the characteristics shown.
- b) Modify the circuit so that the two slopes in the figure are not the same.



7) Estimate v_{out} for the following circuit for a nonideal diode:



in the following situations:

- a) $v = 10 \text{ V}$, $R = 10 \text{ K}\Omega$, $I_s = 10^{-8} \text{ A}$
- b) $v = 1 \text{ V}$, $R = 100 \text{ K}\Omega$, $I_s = 10^{-8} \text{ A}$
- c) $v = 10 \text{ V}$, $R = 10 \text{ K}\Omega$, $I_s = 10^{-9} \text{ A}$
- d) $v = 10 \text{ V}$, $R = 100 \text{ K}\Omega$, $I_s = 10^{-9} \text{ A}$