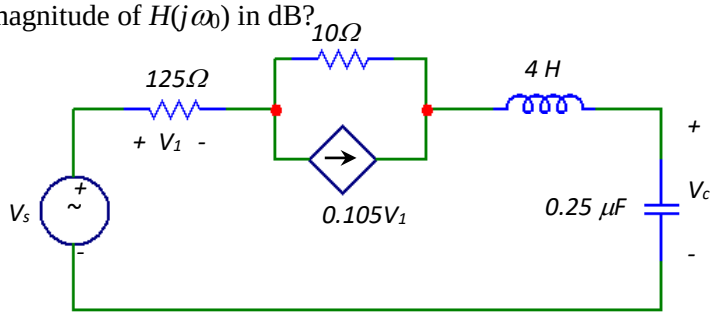
Department of Electrical Engineering, IIT Kanpur ESc 201: Introduction to Electronics

Assignment-5

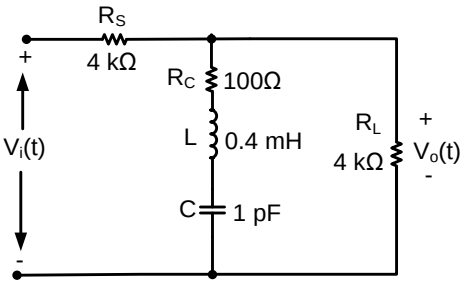
1. Determine the transfer function $H(j\omega)=\dfrac{V_c(j\omega)}{V_s(j\omega)}$ of the following circuit (Fig. 1). Determine the frequency (ω_0, in rad/s) at which the phase of $H(j\omega_0)$ is -90°. What is magnitude of $H(j\omega_0)$ in dB?

Fig. 1



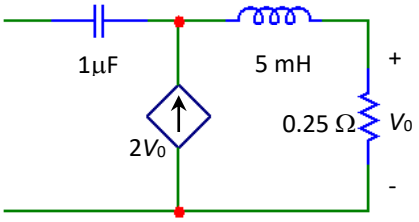
2. A band–reject (notch) filter is shown in Fig. 2. Derive the expression of its transfer function H in the form $H(j\omega)=\dfrac{V_o(j\omega)}{V_i(j\omega}=K\left[\dfrac{(1+ja)}{(1+jb)}\right]$. Find out the expressions for the coefficients K, a and b. Determine the magnitudes of this transfer function at very low and very high frequencies from physical arguments. What is the resonance frequency of this circuit? What is the magnitude of the transfer function at this resonance frequency? Also calculate the level of rejection (in dB) at resonance frequency.

Fig. 2



3. Determine the resonant frequency of the following circuit (Fig. 3).

Fig. 3



4. An inductive load is modeled as an inductance, *L*, in series with a resistance, *R*. (a) When 230 V (RMS) at 50 Hz is connected to the load (Fig. 4a), an average power of 400 W is dissipated in the load. If the power factor of the load is 0.8, calculate the values of *R* and *L*. (b) Calculate the value of the capacitance, C, when connected in parallel with the load (Fig. 4b) makes the overall power factor equal to 1.

Fig. 4a

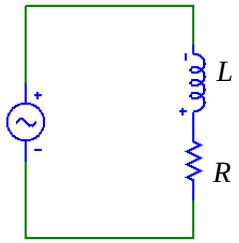
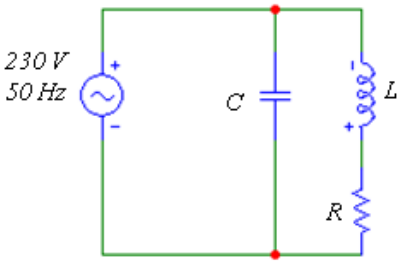


Fig. 4b



5. Determine the output voltage with reference to ground for the circuits shown below (Fig. 5a and 5b) assuming that cut-in voltage of the diode is 0.7V

Fig. 5a

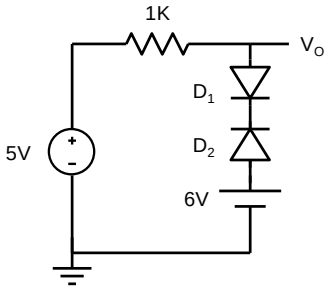
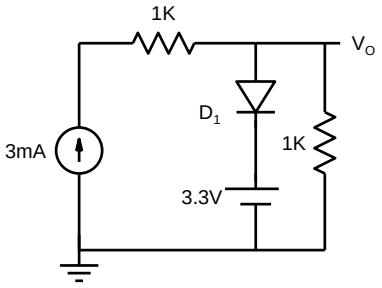
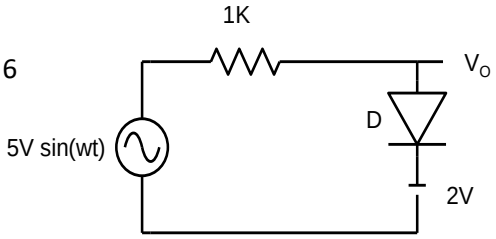


Fig. 5b

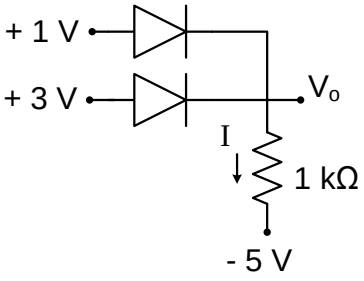


6. Sketch the output voltage vs. input voltage characteristics for the circuit shown below (Fig. 6) assuming ideal diode.

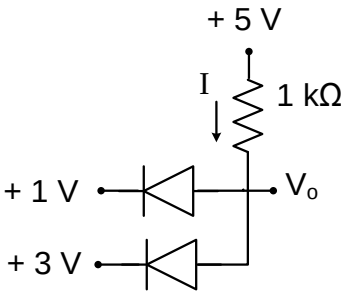
Fig. 6



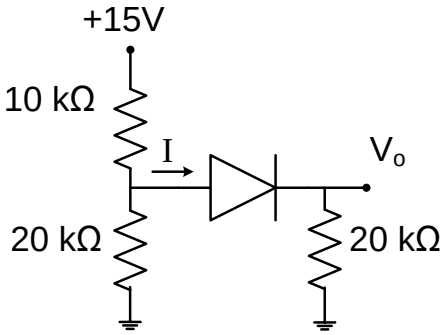
7. For circuits shown below, using ideal diodes, find the voltage (V0) and current (I) indicated.



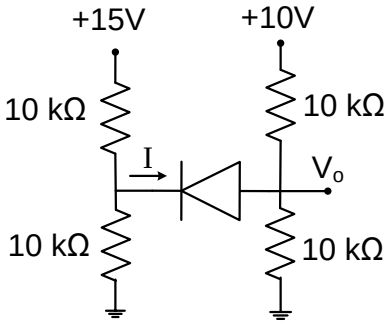
(a)



(b)



(c)



(d)