Q.1-3.

ECE101 Tutorial -11

Draw the **phasor** equivalent circuit, where all the actual circuit elements are replaced by their equivalent (complex) impedances, for each of the **five** given circuits in the sinusoidal steady state. Write down the **node** equation(s) for each circuit in terms of the phasor(s) representing the node voltage(s) as indicated, and hence obtain an expression for the output voltage phasor V_o in terms of ω and the input voltage phasor V_s.

Then obtain the following for each problem:

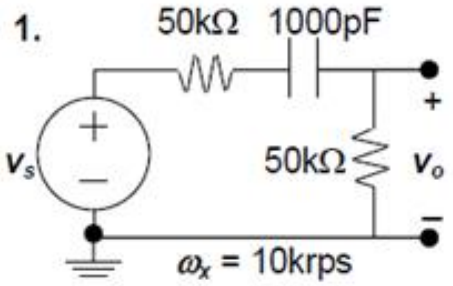
a) The Transfer Function $H(j\omega) = V_o / V_s$, its Magnitude $|H(j\omega)|$ and Phase angle θ as functions of ω.

b) The values of $|H(j\omega)|$ and θ at $\omega = \omega_x$ (the value of ω_x is specified in each problem).

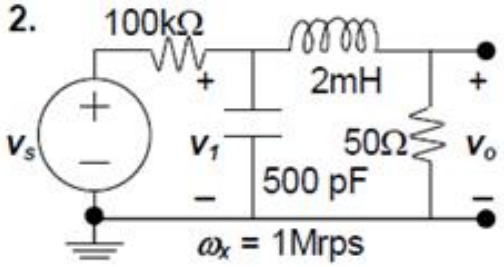
c) The asymptotic expressions ($\omega \to 0$ and $\omega \to \infty$) for $|H(j\omega)|$ and hence the slopes of the low-frequency and high-frequency asymptotes (in **dB / octave**).

d) Infer the nature of the frequency response:
i.e. identify whether the filter response is Low pass/ high pass/ band pass.

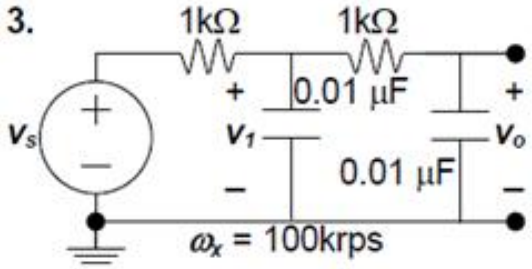
1.



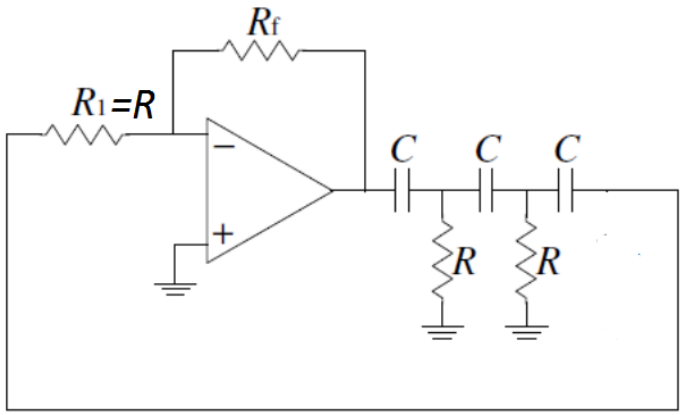
2.



3.

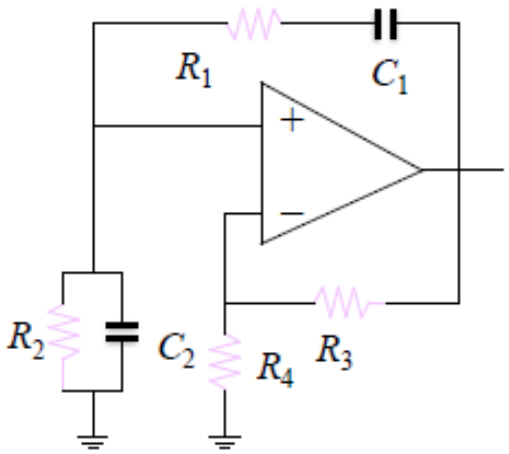


Q.4. Determine the value of capacitance C and the value of R_f of the RC Phase-shift oscillator as shown below if the output frequency is 1kHz. Take R =10 k-ohm.



Q.5. Students should obtain the general condition using Barkhausen Criterion (assuming respective R_1, C_1 and R_2, C_2 are not equal. Ref. oscillator Lec slides, in which $R_1=R_2$ and $C_1=C_2$ are used to find β, feedback ratio)

$$\frac{R_3}{R_4} = \frac{R_1}{R_2} + \frac{C_2}{C_1} \qquad \text{.....(1)}$$



Determine the value of capacitance C_1 and R_1 if R_2 =10k-ohm C_2 = 0.1µF, R_3 =10kΩ, R_4 =1k-ohm in the Wien bridge oscillator shown has an output frequency of 1kHz.