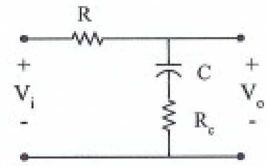
Serial #

King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE205: Electric Circuits II (031)
Quiz 8

Name: KEY

For the circuit shown:



a) Derive an expression for the transfer function *H(s)* where *H(s)=Vo/Vi* **(3 points)**

b) At what frequency will the magnitude of $H(j\omega)$ be maximum. **(1 point)**

c) What is the maximum value of $H(j\omega)$? **(1 point)**

d) At what frequency will the magnitude of $H(j\omega)$ equal its maximum value divided by $\sqrt{2}$? **(4 points)**

e) what is the minimum value of the magnitude of $H(j\omega)$ and at what frequency does it occur?

a) By voltage divider.

$$H(s) = \frac{V_o}{V_i} = \frac{R_c + 1/sC}{R_c + 1/sC + R} = \frac{R_c C\, s + 1}{(R_c + R)Cs + 1}$$

b) $$|H(j\omega)| = \frac{\sqrt{(R_c C\omega)^2 + 1}}{\sqrt{(R_c + R)^2 C^2 \omega^2 + 1}} = \frac{\sqrt{R_c^2 C^2 \omega^2 + 1}}{\sqrt{(R_c C + CR)^2 \omega^2 + 1}}$$

c) at $\omega = 0$ $\quad |H(j\omega)|_{max} = 1$

otherwise always $(R_c C + CR)^2\omega^2 > R_c^2 C^2 \omega^2$ & $|H(j\omega)| < 1$

d) $$\frac{C^2 R_c^2 \omega^2 + 1}{(C^2 R_c^2 + 2R_c R C^2 + C^2 R^2)\omega^2 + 1} = \frac{1}{2} \Rightarrow 2C^2 R_c^2 \omega^2 + 2 = C^2 R_c^2 \omega^2 + 2R_c R C^2 \omega^2 + C^2 R^2 \omega^2 + 1$$

$$\Rightarrow C^2 R_c^2 \omega^2 - 2R_c R C^2 \omega^2 - C^2 R^2 \omega^2 = -1$$

$$\omega^2 = \frac{-1}{C^2 (R_c^2 - 2R_c R - R^2)} \Rightarrow \omega = \frac{1}{C\sqrt{R^2 + 2RR_c - R_c^2}}$$

e) $$|H(j\omega)_{min}| = \frac{R_c}{R_c + R}$$ voltage divider as $\omega \to \infty$

Good Luck, **Dr. Ali Muqaibel**