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17/ENG02/045
Computer Engineering

EEE 322
Assignment.

Determine the type of filter shown below and show that its cut off frequency is $w_c = \frac{1}{RC}$

Solution

The figure shows a LOW PASS filter to obtain its cut-off frequency w_c

$$\frac{V_o(s)}{V_i(s)} = \frac{\frac{1}{sC}}{R+\frac{1}{sC}} = \frac{\frac{1}{jwC}}{R+\frac{1}{jwC}}$$

$$H(w) = \frac{1}{1+Rjwc}$$

Cut-off frequency is obtained by setting the magnitude of $H(w) = \frac{1}{\sqrt{2}}$

$$|H(w)| = \frac{\sqrt{1^2}}{\sqrt{1^2+(Rjwc)^2}} = \frac{1}{\sqrt{2}}$$

$$H(w) = \frac{1}{\sqrt{1+w_c^2R^2C^2}} = \frac{1}{\sqrt{2}}$$

$$\sqrt{2} = \sqrt{1+w_c^2R^2C^2}$$ ← (square both sides)

$$2 = 1+w_c^2R^2C^2$$

$$2-1 = w_c^2R^2C^2$$

$$\frac{1}{R^2C^2} = w_c^2$$ (take square root of both sides)

$$\frac{1}{RC} = w_c$$

$$w_c = \frac{1}{RC}$$ //