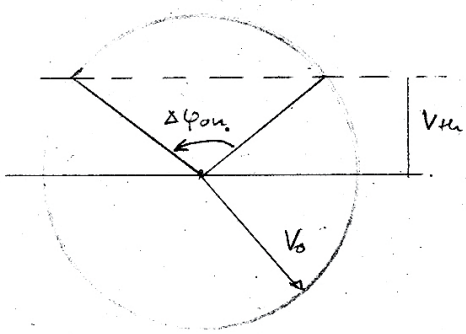
AC Circuits

Additional Problems

11.



V_{th} (threshold voltage

fraction LED is on: $\frac{\Delta t_{on}}{T} = \frac{\Delta\varphi_{on}}{2\pi}$

$\cos\frac{\Delta\varphi_{on}}{2} = \frac{V_{th}}{V_0} \Rightarrow \Delta\varphi_{on} = 2\cdot\arccos\frac{V_{th}}{V_0} = 2\cdot\arccos\frac{2{,}5}{7}$

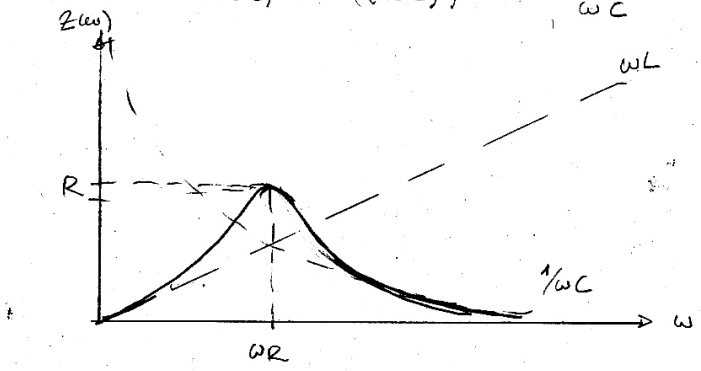
$= 138° = 2{,}4\ \text{rad}$

$\Rightarrow \frac{\Delta t_{on}}{T} = 0{,}38 = \underline{38\%}$ of a period

12. $Z(\omega) = \left(\frac{1}{R^2} + \left(\frac{1}{\omega L} - \omega C\right)^2\right)^{-1/2}$

$\omega \to 0$: $Z(\omega) \sim \left(\left(\frac{1}{\omega L}\right)^2\right)^{-1/2} = \omega L$ (→ straight line through origin)

$\omega \to \infty$: $Z(\omega) \sim \left((\omega C)^2\right)^{-1/2} = \frac{1}{\omega C}$ (→ hyperbola)



maximum for $\left(\frac{1}{\omega L} - \omega C\right) = 0$

$\Rightarrow \omega_R = \frac{1}{\sqrt{LC}}$

high impedance in a frequency band around ω_R → low intensity signal for this frequency band → band is rejected

13. $Z(\omega) = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$ → minimum for $\omega L - \frac{1}{\omega C} = 0$

→ $\omega_R = \frac{1}{\sqrt{LC}}$ / $f_R = \frac{1}{2\pi\sqrt{LC}}$

$f_R = \frac{1}{2\pi\sqrt{3{,}3\cdot 10^{-3}\,H \cdot 68\cdot 10^{-12}\,F}} = \underline{336\ kHz}$