Electronics (3)
Third Year - First Term
Fall 2011

## Sheet 5

## Waveform Generators

## Problem 1)

For the triangular wave generator shown in the figure, find:

- $V_{\text {Omax }}$ and $V_{\text {Omin }}$.
- $\mathrm{T}_{1}, \mathrm{~T}_{2}$, frequency and Duty cycle.
- If $\mathrm{V}_{\mathrm{CC}}=10 \mathrm{~V}$, find the values or the ratios of the resistors, $\mathrm{C}, \mathrm{V}_{\mathrm{R}}$, and $V_{S}$ to obtain a triangular waveform with the following specifications:
- $\mathrm{f}=10 \mathrm{KHz}$, offset=$=0$, Peak $=5 \mathrm{~V}$, and
 Duty cycle=1/3


## Problem 2)

The triangular wave generator shown consists of a bi-stable circuit followed by a non-inverting integrator. Describe its operation and hence, given $\mathrm{R}_{1}=\mathrm{R}_{2}=10 \mathrm{~K}, \mathrm{R}_{3}=1 \mathrm{~K}, \mathrm{C}=0.1 \mathrm{nF}, \mathrm{V}_{\mathrm{CC}}=15^{\mathrm{V}}$, find:

- The output frequency.
- The peak-to-peak voltage of the waveform.


## Problem 3)

For the mono-stable circuit shown, find:

- The minimum input triggering pulse $\left(V_{t}\right)$.
- The condition on $R_{1}$ and $C_{1}$ for proper operation of the circuit.
- The pulse width.
- The minimum duration between
 triggering pulses.

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## Problem 4)

For the mono-stable circuit shown using 555 IC, find:

- The minimum input triggering pulse $\left(\mathrm{V}_{\mathrm{t}}\right)$.
- The condition on the pulse width for proper operation of the circuit.
- The pulse width.
- The minimum duration between triggering pulses.


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## Problem 5)

For the astable circuit shown using 555 IC , find $\mathrm{T}_{\mathrm{H}}, \mathrm{T}_{\mathrm{L}}$, and frequency of the resulting waveform.


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## Problem 6)

A voltage controlled square wave generator (VCO) is shown. The frequency of the oscillator is controlled by a multiplier circuit with an input dc voltage $\mathrm{V}_{\text {ref }}$.

- Sketch the output waveform and derive an expression for the output frequency as a function of $\mathrm{V}_{\text {ref }}$.
- What are the advantage and disadvantage of this VCO compared to other types of VCOs?


