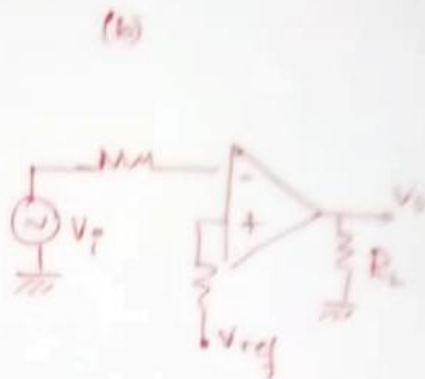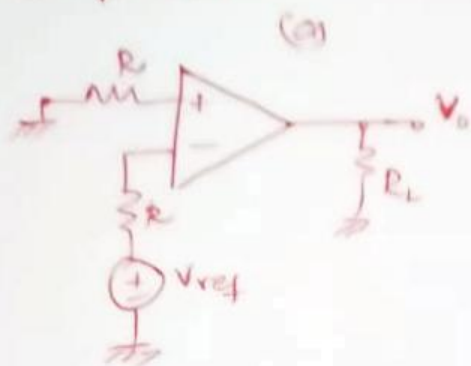20. Consider an inverting and non-inverting comparator.
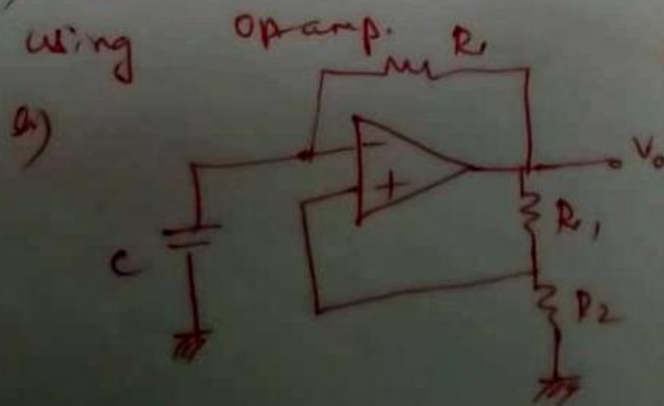
(a)

(b)

Draw the input and output waveforms

31. a) Explain the operation of Schmitt trigger in detail with suitable waveforms

b) A Schmitt trigger with upper threshold voltage $V_{UT} = 0V$ and hysteresis width $V_H = 0.2V$ converts a 1KHz signal sine wave of amplitude $4V_{PP}$ to a square wave. Calculate the time duration of negative and positive portion of the output waveform.

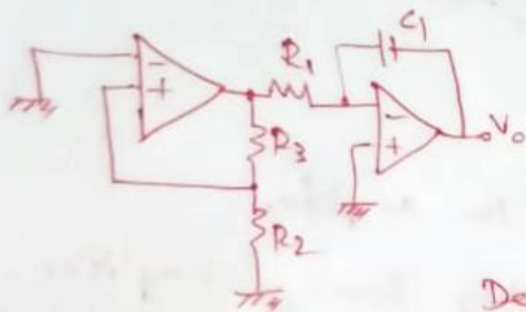32. a) Explain the operation of astable multivibrator using op-amp.

Calculate the frequency of oscillation

$R_2 = 10k\Omega$, $R_1 = 11.6k\Omega$

$R = 100k\Omega$, $C = 0.01\mu F$

33. a) Explain the working principle of triangular wave generator & derive the frequency of oscillation

If $T = 1ms$,

$V_{o(PP)} = 5V$

$V_{sat} = \pm 10V$

Design a triangular wave generator.

34. a) ~~Design~~ Explain RC phase shift oscillator with necessary conditions for sustained oscillation.

b) Design RC phase shift oscillator for $f_0 = 1MHz$,

Assume $C = 0.1\mu F$, $R_1 = 10R$